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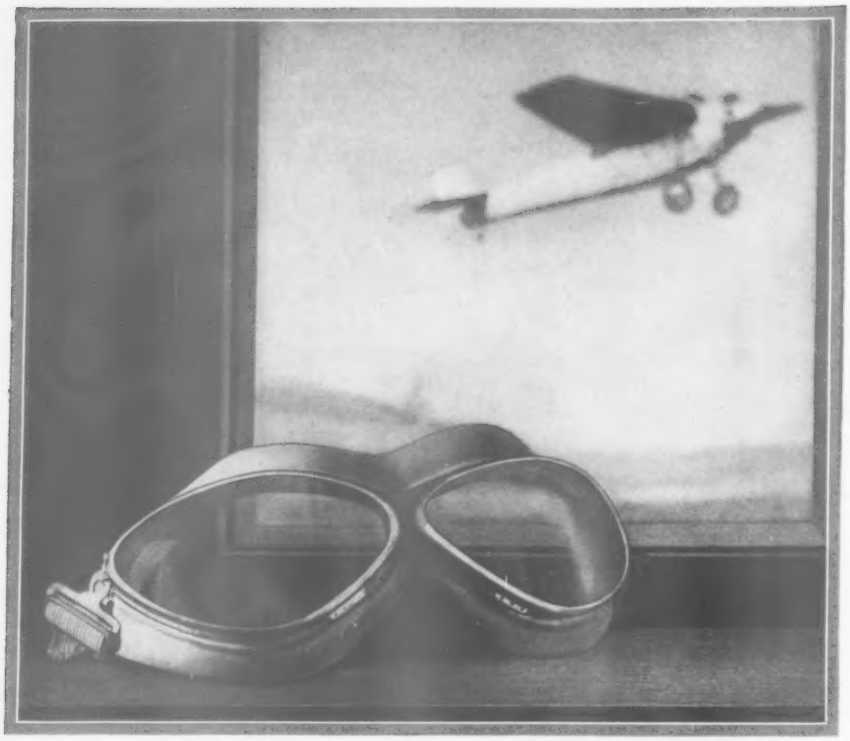

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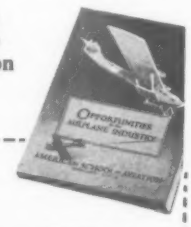

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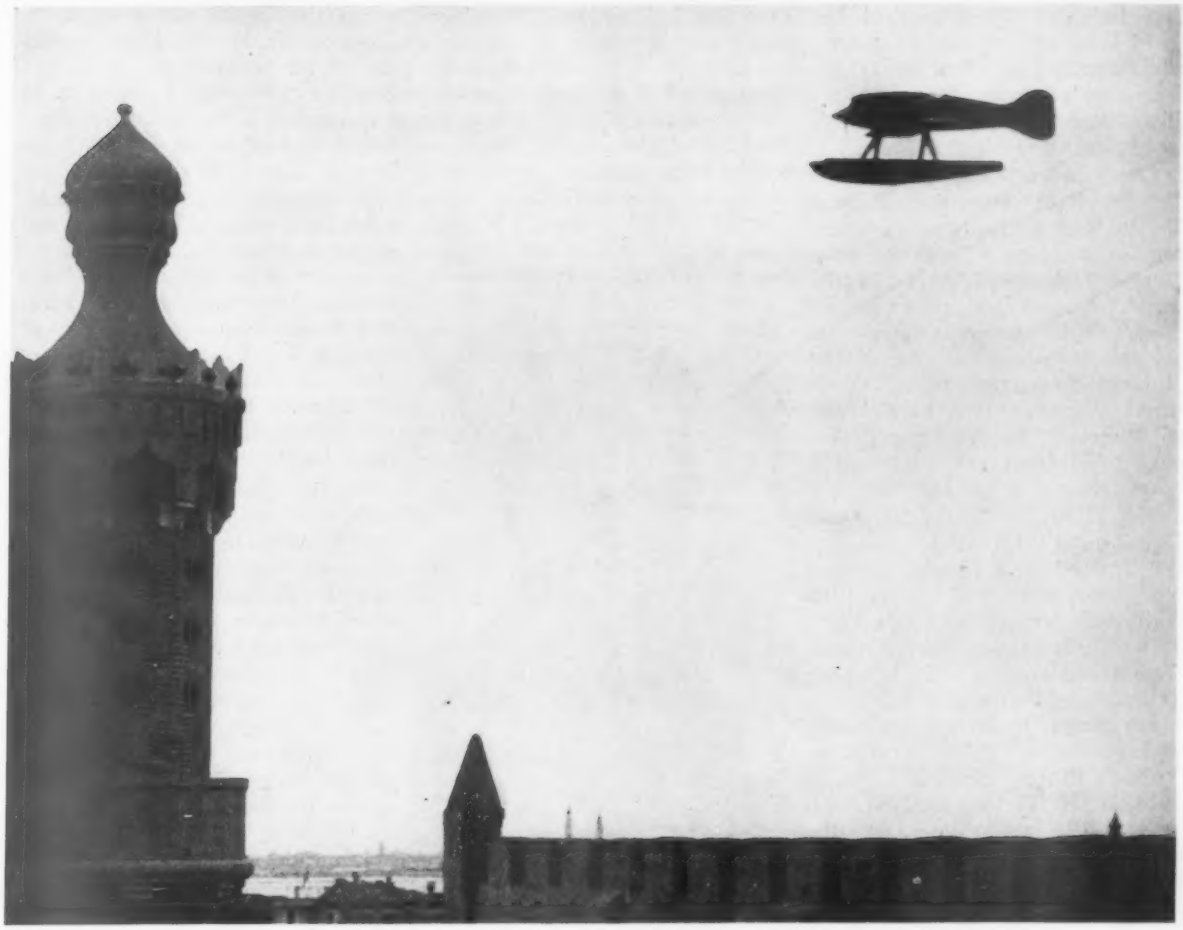


Airplane Racing

By Lt.-Cdr. F. W. Wead, U. S. N.

ON September 27th, 1927, a tiny racing seaplane bearing the insignia of the British Royal Air Force flashed across the finish line in the historic Schneider Trophy Race at Venice, Italy. On the nearby scoreboard the average speed of the victor was chalked up as 281.5 mph. Recent spectacular flights have made the man in the street blase as far as flying is concerned. Even crashes are getting to be back page news. But there can be no doubt that this speed thrilled the aviation world; 281 miles per hour around the triangular course at Venice with its two hairpin turns meant at least 305 straightaway, and in a seaplane! With wheels instead of floats this British Supermarine-Napier would do 320 mph, possibly 330! And it will.

Then, as an anti-climax, Mario de Bernardi, Italian speed king, slapped a smaller set of wings on his defeated Schneider Cup racer and set an observed speed record over the three kilometer straightaway course of 316 mph plus! Is 400 miles per hour in sight? Well, just about. 350 is a cinch right now. In a landplane, of course.

What does this speed mean? What do these racing pilots go through? Is it all just a stunt? Publicity stuff of no practical value?

Airplane racing is far from being purely spectacular. It has been of untold benefit in the development of Army and Navy and commercial aircraft and aircraft engines. During 1921, 1922, 1923, 1924 and 1925 the United States had a clear cut speed lead over the other nations of the world. It is to a considerable extent due to this fact that we have the finest pursuit and fighting planes in existence today.

In 1926 this lead passed to Italy with Major de Bernardi's victory in the Schneider Cup of that year at Norfolk, and it has now passed to England, with Italy still hanging close on the British tail. In the last Schneider Trophy race all Italian entries were forced down by engine failures. It would therefore appear

that Italy has about reached her speed limit with present equipment, while England still has leeway for considerable advance by means of minor improvements in present high speed planes and engines.

The Jacques Schneider Seaplane Trophy Race and the Pulitzer Trophy Race for landplanes are, and for ten years have been, the most famous high speed events in the world. A word about the history of these two famous competitions and the pilots who have repeatedly pushed the maximum rate of man's travel through space beyond the point thought possible by even the most rabid fanatic of a few short years ago.

The Schneider Trophy Race was first flown in 1913. In that year Col. Bill Thaw, later a famous war ace, represented the U. S. From 1913 until 1923 (except the years 1915-1918 when it was not held because of the war) this competition has been a hard-fought annual struggle between England, France and Italy, with results as follows: 1913, M. Provost, France, speed 45.25 mph; 1914, C. H. Pixton, England, 86.0 mph; 1919, Janello Italy, was the only pilot to finish the course, his speed was announced at the then impossible figure of 124.89 mph, but he was later disqualified for unintentionally cutting the course due to heavy, low-lying fog; 1920, Luigi Bologna, Italy, 106.7 mph; 1921, Italy, 110.9 mph.

It is interesting to note the gradual gain in speed in these and subsequent years. The rules for this race provide that any country winning three times in five years gains permanent possession of the trophy. In 1922 Italy had two wins and looked to be a certain three-time winner. Mr. H. Scott-Paine of the English Supermarine Aviation Works, however, built the Supermarine Sea Lion at no little expense and his pilot, Captain Henry Baird, won at Venice at a speed of 145.7 mph, thereby returning the coveted Schneider Trophy to the rooms of the Royal Aero Club in London, where some one remarked that it was a very "hat-rack-tive" cup. In 1923 the U. S. Navy entered the Schneider Trophy Race and sent a team of four pilots with four ships to Cowes under the command of the writer. This year Capt. Baird was again entered with an improved Sea Lion (finished third) six French entries (of which by rule only three are allowed to start) were eliminated by crashes and mechanical troubles, and a second British entry, the Blackburn Pellet with Mr. Reg Kenworthy as pilot, was crashed during the preliminary navigability trials. Lieut. Dave Rittenhouse, USN, finished first in a Curtiss-Navy CR3 racer, and Lieut. R. Irvine was second in a similar ship. The course, which is 200 nautical miles plus or minus not more than ten per cent, was flown by the winner at 177.38 mph. (The navigability trials consist of take offs, landings, taxying, and mooring out.) In 1924 the race was scheduled for Baltimore, but was cancelled at the last moment due to accidents that eliminated all foreign entries, the U. S. refusing to take a walk-over. In 1925 the U. S. Army for the first and only time entered the Schneider Trophy competition at Baltimore, and Lieut. J. H. Doolittle of the Air Corps (recently famous for outside loops) finished first at 232.57 mph. The Italian entry finished second. This race was replete with disasters. The two U. S. Navy entries, flown by Lieuts. George Cuddihy and Ralph Ofstie, were forced down during the race, as was the English Gloster-Napier 4, flown by Mr. H. Broad, and as was the second Italian ship. A second English contestant, a high speed Supermarine again flown by Capt. Baird, was crashed a few days before the race.

Major Mario de Bernardi, who now holds the world's record for speed (unofficial).

In 1926 Premier Mussolini spoke a few terse words to the aircraft and engine builders of Italy and to the best pilots of the Italian R. A. F. As a result Major Mario de Bernardi flew the Italian colors to victory at Norfolk in the annual Schneider classic of that year at a speed of 246.49 mph. Lt. C. F. Schilt, U. S. Marine Corps, was second, and another Italian ship finished third.

By this time England's repeated failures in racing and record breaking flights had begun to rankle in the breast of the British Lion. As a result the English Air Ministry ordered a number of ships and put a 1927 team of R. A. F. pilots in the field with results as noted in the opening paragraph.

In this year, 1927, the U. S. Navy had dropped out of the race because of the expense involved, and a determined effort was made by Lieut. Al Williams, U. S. N. (also noted for outside loops and as a racing pilot and one time holder of the world's speed record), backed by private capital, to build an entry and get it ready in time. This effort was a highly commendable one, and its failure was sincerely regretted here and abroad. It is to be hoped that future years will again see the United States contesting for this historic trophy, which carries with it a record of competition surpassed by none other in any branch of sport.

The Pulitzer High Speed Race for landplanes was won in 1921 at Omaha at 170 mph plus (this and the figures given below are approximate) by Bert Acosta in a Navy racer. In 1922 Lieut. Russell Maughan (Dawn to Dusk transcontinental pilot) was victorious at Detroit with a speed of 212 mph plus.

In 1923 the Navy made a clean sweep of all places at St. Louis, Lieut. Al Williams winning at 233 mph plus. In this race Williams had a very narrow margin over the runner up, Lieut. Harold Brow, USN, flying an identical ship. Before the race Williams flew over the St. Louis course repeatedly, until he knew the ground below it by heart,

and also walked over it, placing weighted papers and other markers to aid him in following the course as closely as possible. In racing the slightest deviation up or down or to the right or left means a direct loss in speed. Inches count. It is for this reason that racing planes fly low.

At St. Louis pilots were required to dive across the starting line on beginning the race and at once make a sharp turn onto the course. Turns slow up a racing plane and cause it to squash outward and lose speed. Williams, unknown to the other pilots, consulted with the judges, was assured that his plan did not violate the rules, and dove across the line at a very sharp angle almost parallel to it, so that his first turn was not as sharp as that of the others had been.

His foresight, careful preparations and superb flying skill brought him

Lt. Raoul Lufbery and Lt. William Thaw (right). Thaw represented the United States in the first Schneider Cup Race in 1913.

a well deserved victory. In airplane racing, as in most things, the fastest entry usually, but not always, wins.

After the Pulitzer Race at St. Louis Williams and Brow moved their ships to Mitchell Field, Long Island, for a go at the 3 kilometer straightaway world's high speed record. For several days they repeatedly climbed their tiny racers high into the Heavens, pointed them straight down with the gun full on, and leveled out just off the earth to sweep over the 3 km. course. The honors seesawed back and forth. First one held the record, then the other.

Finally, to avoid possible disaster, Admiral Moffett, Chief of the Bureau of Aeronautics and head of Naval Aviation, decreed that each pilot should have only one more trial. Again Williams came out a scant margin ahead of his rival, setting an average speed of 266 mph. plus for a new world's record. (Four passes, two each way, over the 3 km. course are averaged to obtain the final result.) As a result of the dangers incurred in this duel for speed, where the slightest error in judgment would have dashed the ship into the ground as it pulled out of its dive, the Federation Aeronautique Internationale, governing international body having supervision over all aircraft records, changed the 3 km. course to eliminate a diving start by placing an outlying marker beyond each end of it, over which the pilot must pass in level flight.

In 1924 the Pulitzer race was not held. In 1925 it was won at Mitchell Field by the late Lieut. C. K. Bettis of the Army Air Corps with a speed of 243 mph. plus, Lt. Al Williams of the Navy finishing second. Lieut. Bettis flew the same ship that Lieut. Doolittle later used on floats to win the Schneider Cup at Baltimore.

Since 1925 the Army and the Navy have abandoned the Pulitzer Trophy Race. This high speed event has usually been the "pièce de resistance" of the Annual National Air Races. Since 1925 a free-for-all race for Army and Navy pursuit and fighting planes has been held in its place.

The Schneider and Pulitzer Trophy Races, in fact all airplane races, are run around a triangular or other geometrical course, the turning points of which are marked by pylons. Planes usually start in succession or in pairs and race primarily against time, in order to avoid dangerous crowding at the turns. Some pilots use chalk marks on the stick or instrument board to keep track of the laps, erasing one each time they pass the judge's stand. It is almost impossible to remember the number of laps that have been flown while racing, and it is essential that these ships land soon after they have flown the complete race, as they are usually about out of gas.

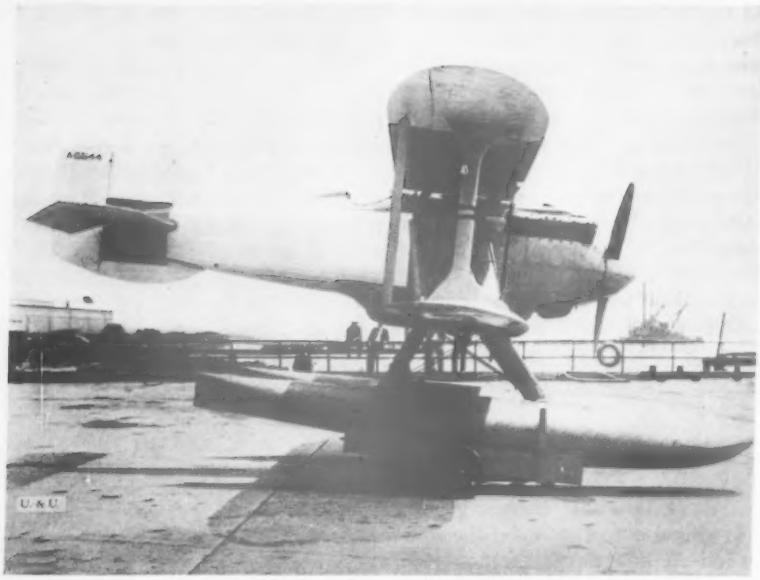
With two ships evenly matched, the one that adheres more closely to the course will invariably win. Turns, too, may spell the difference between victory and defeat. Before the 1927 Schneider Trophy Race the winning British pilots made innu-

Lt. Cyrus K. Bettis, who won the Pulitzer Race at Mitchel Field October 8, 1925, 243 miles per hour.

merable timed turns before a slow-motion-picture camera to determine the fastest method. The experience of American pilots indicates that racing ships should be banked up to the point where the centrifugal force does not quite begin to cause the engine to rev down. This varies somewhat in different ships and is determined by trial turns in the air. If the ship is thrown sharply into a vertical bank it tends to squash out, losing ground, and to rev down, requiring some time for plane and engine to work up to top speed again. For this reason the inner wing is usually dropped some distance before the pylon at the turning point is reached, and the turn completed as outlined above, keeping as close to the pylon as possible and exercising due care not to cut the course.

There has long been considerable argument about racing pilots tending to "go dead" in turns, owing to the action of centrifugal force upon the blood in the body. Some pilots have reported this sensation but most of them have not.

In general, racing planes fly like



The Navy Seaplane — Cowes, England, September 28, 1923, which made 177.5 miles per hour.

other planes, *but* they are usually blind, sensitive and often tricky on the controls. Their high landing speeds require smooth and large fields or water areas for take offs and landings. In order to glide and land slowly Lieut. Sanderson, U. S. M. C., a well known and expert racing pilot, at one time made a practice of cutting his switch on and off while approaching to land. In gliding into Lambert Field immediately after the 1923 Pulitzer Race at St. Louis (whether in this manner or not has never been definitely stated) his engine suddenly quit and he was forced to kick his ship into a nearby corn field to avoid a remote possibility of striking spectators. The result was a complete washout, but "Sandy," with his customary good luck, "walked away from it" without a scratch.

The terrific air blast past a racing plane makes it essential that the pilot's head be completely protected. To avoid all possible resistance these ships are cowled so closely in around the pilot that he is often said to be "tailored into his seat" or "to need a shoe-horn to help him in and out." As a result flying visibility is very poor and this complicates the smooth landing problem and makes flying of any kind difficult.

Racing pilots must keep cool and think fast. Near the home pylon a tremendous crowd of spectators and automobiles must be considered. While flying low along the course instantaneous action is necessary to avoid disaster in case of engine failure. Racing planes are always more or less experimental and first test flights require high skill and good judgment while the "bugs" are being eliminated. For these reasons we find pilots who have demonstrated their ability in service flying selected to fly high speed racers. Men like Maughan, Doolittle, Cuddihy, Ofstie, Rittenhouse, Williams, Brow, etc., are not only racing pilots, they are also general pilots of superior skill and much experience.

Lt. Russell L. Maughan, who won the Pulitzer Race at Detroit in 1922, with a speed of 212 miles per hour.

The advances made in the structure and design of aircraft and engines because of airplane racing have been great and widespread. In this mad race for speed the power output of the engines used is increased in every possible way. Any gain in power without increase in size or weight is a direct gain in speed. Stimulated by the never ceasing cry for more miles per hour, r.p.m. have been boosted and compression ratios increased, necessitating the use of doped fuels, beyond points at one time believed possible. To make these engines stand up under this increased load it has at times been necessary to strengthen crankshafts, coon rods, water jackets, etc. As a result of these lessons we find service engines delivering more horsepower per lb. and standing up better in service.

Streamlining has also received a great stimulus through the development of racing planes. On racers every fitting is "hidden," and pontoons, landing gears, etc., are shaped in accordance with the most efficient aerodynamical forms. Some of these lessons, too,—propellor spinners for example,—find their way from the experimental laboratory and supreme test of airplane racing into the wide field of general use. Wing radiators, invariably found in racing planes, are not adapted for Army or Navy aircraft, primarily because of vulnerability to machine gun fire and susceptibility to extreme cold. This lat-

ter objection may also limit their use in commercial planes.

A few years ago a landing speed of fifty miles an hour was considered excessive. The 1927 British Schneider Cup racers landed at about 125 mph.! A high landing speed gives a greatly increased top speed in any airplane. As a result of racing we find the landing speeds and hence the high speeds of all types slightly greater than they were some years ago. There are other considerations that affect landing speeds, particularly where safe landings must be made in small or rough fields and in weight-carrying aircraft, but the tendency is there, and to racing must go the credit for it.

In the 1927 British Schneider Cup racers the carburetors, magnetos, etc., usually found between the banks of the engine were placed forward or aft of the cylinder banks and in line with them. It was thus possible to cowl in closely around the cylinders and also around the crankcase, which was specially shaped in *streamline form* to conform to the shape of the fuselage. These Napier Lions had a compression ratio of 10 to 1, used straight benzol (non-detonating) for fuel, turned 3,300 r.p.m. (direct drive), weighed 835 lbs., and delivered 875 horsepower, or a weight of only .954 lb. per horsepower! Imagine a service fighter built around that engine!

The winning Supermarine-Napier at Venice (1927) was geared down to 2,850 r.p.m. at the prop and the gears and casing weighed 85 lbs., giving 1.05 lbs. per horsepower. This ship was some 8 miles per hour faster than its sister ship (direct drive) that finished second, which clearly shows the value of gears as far as speed is concerned. This Napier engine is identical with that used by Capt. Malcolm Campbell when he recently drove an automobile 206 mph. plus at Daytona, Florida. The development of our own Curtiss D-12 and V-1550 engines into the excellent pursuit power plants that they are today has been to some degree due to racing.

In 1927 the British for the first time built an air-cooled Short-Bristol racer (for the Schneider Trophy). This is of interest because of the growing use of this type of engine in commercial work and its great value in fighters where high rate of climb as well as high speed is required. It is understood that the British pilots favored this air-cooled ship, which unfortunately was crashed a few days before the race, over their water-cooled jobs. It appears that the lighter, smaller-winged, blunter nosed air-cooled racer may be superior in speed to a similar heavier water-cooled racer that has the same landing speed. It is certain that our air-cooled engines and the development of air-cooled airplanes would benefit tremendously by an attempt to break existing world's speed records with an air-cooled ship.

This article has been devoted entirely to high speed racing. It has been a long, interesting struggle from the tiny stick and wire box-kite that won the Schneider Trophy in 1913 at 45 mph. to the sleek high powered flying bullet that traveled 300 mph. straightaway at Venice in 1927. It has been a struggle fraught with danger and often marred by disaster, but it has contributed beyond all measure to the development of all phases of flying.

When the next war breaks out it should be a great satisfaction to any nation to feel that their designers

(*Continued on page* 86)

The R-2C-2 "Standby" of the U. S. Navy, entered in the Schneider Cup Race at Baltimore, October 24, 1925.

We Take a Little Trip

By C. R. Borkland
Popular Aviation

THE public has been fed up a little with accounts of nice, easy, fast trips, and it may be that a little account of a trip taken under about all the difficulties possible will give some people an idea of what the transport companies are doing to overcome them.

This trip was undertaken for purely business reasons, and business dictated taking the air. From a purely dollars and cents standpoint it paid. Figure the cost of transportation from Chicago to San Francisco, from the Golden Gate City to Los Angeles, then to San Diego, back to Los Angeles, from there to Salt Lake City, Denver, Wichita and back to Chicago.

Figure the expense of berths, meals, tips and all the other little extras you never can remember and have to lump on the swindle sheet as "misc." Then put a conservative value on your wasted time, the time you spend reading magazines on the train, looking out of the window, trying to sleep nights, trying to stay awake daytimes so you can sleep nights.

It actually figured a clear gain in money, and it also permitted me to travel on Sundays, nights and other times out of business hours.

Let me say right here that you do not meet with any misrepresentation when you apply for passage with the air transport companies. You are told that you may be delayed for weather reasons, that portions of the trip may be uncomfortable, and that you may not particularly care for it. Quotas of passengers are not hard to fill; in fact, on many of the lines you cannot fly when you please, unless you take the precaution of booking in advance.

These cloud Pullmans are apt to be as crowded as any of the rail variety. In fact, the only difference that I can see is that the air transport companies have no upper berths to push you into. Boeing tells me that the first of June they will put on two twelve passenger busses in place of the two place and pilot jobs now used. At first only for the week end runs, but later for the daily runs.

That ought to help the crowding some, for then the passengers won't have to nurse mail sacks part of the way. Anyway, I'm getting away from the point.

J. E. Leopold, who was in charge of the hangar at Chicago Municipal Flying Field took my $200 and in-

troduced me to Billy Rose, the song writer, who was to be my fellow passenger. Rose was trying to get out to the coast to see Fanny Brice's new act open on Monday at Los Angeles. It was Saturday night. He made it.

Not being a successful song writer, but a poor drummer boy who earns his salt by telling folks how good his wares are, I figured that by leaving Saturday night I would be able to go to work in San Francisco Monday morning with no loss of time. I made it, too.

That morning it was only eight below zero in Chicago, and try as I might I couldn't keep my mind fixed on sunny California. Somehow or other my feet kept reminding me that I was in the Windy City with the Bomby Climate. Fortunately my trunk yielded up a lot of old flying togs and I felt I would not suffer from the cold.

The weather reports from points along the line were not so encouraging. Ralph Johnson, our pilot, decided to wait a while. It had warmed up a little, a few degrees, and was snowing. We loafed, swapped lies and nodded until 3:27 A. M. in Boeing's warm hangar. By that time Billy Rose had decided that we could reach the Pacific Coast quicker by walking.

Johnson started and pushed us over Illinois at about 130 miles per hour, in what was as interesting a night ride as anyone could ask for—if they stayed awake. But not worrying about the Illinois terrain, as I have had the pleasure of seeing it from that angle, and many others, many times for many years, I let old man Snooze take charge, and Rose and myself were soon asleep.

By three o'clock it had cleared and all Elk Mountain had turned out to see us off.

The drone of the engine ceased and I woke up by the reverse alarm clock method at 5:05 A. M. We were pulling into Iowa City. Ten minutes were not enough to see the city, so we stayed in while the plane was gassed up. We left at 5:15.

More rest. Rose may be a regular song writer, but he never could write words to fit his snore, and make a hit out of it. I woke again with a start—it was 8:19 and we were in Omaha.

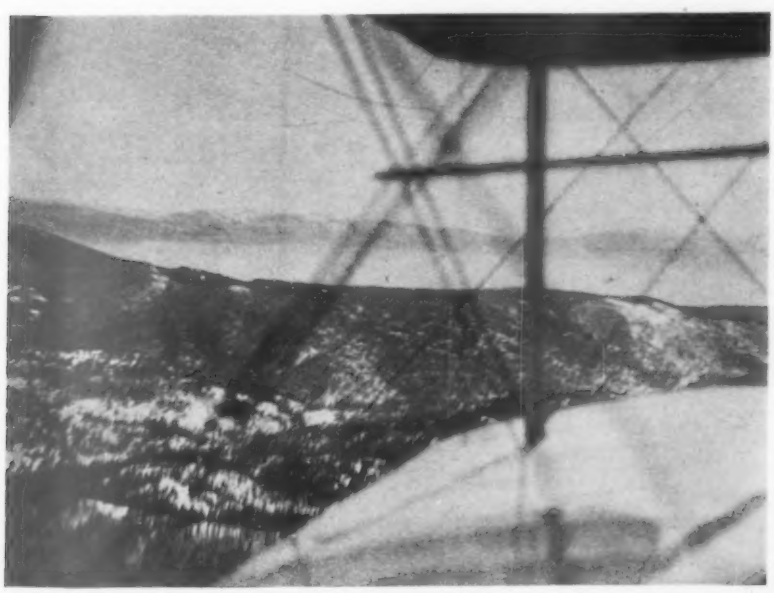
Doc Coomer announced that we could stretch our legs. Doc and C. A. Sluder told us that the water had frozen, but they had secured a breakfast for us. That was welcome, but we had to eat it in the ship, as we only waited twenty minutes while they changed the mail from one ship to another.

There was no loafing after getting started, but the start was a long pull. This time the weather was clear. It was 7:39 A. M. Talk about air travel being fast, here we are leaving a city forty minutes before we arrive there. L. L. Bowen, the pilot for this section, tells us to set our watches back an hour.

The country west of Omaha is flat and uninteresting. We are flying low. At 10:00 A. M. we arrive at North Platte, and stay only ten minutes. We leave in the same ship with Bowen still piloting.

More flat country and we reach Cheyenne at 11:20. H. B. Shaver is in charge of the field here, and is as pretty a field as you could ask for. About thirty miles off the mountains rise right up off the plains.

Neither Rose nor myself are so keen about the nice lunch they had for us. Henry Boonstra is flying us.



If there ever was a gem in a natural setting it is Lake Tahoe as viewed from the air.

C. K. Vance was our pilot out of Reno.

We take off right for the mountains straight at Sherman Hill, which has the highest beacon in the world on it. If they call these things hills, how high are their mountains?

It was just noon when we left Cheyenne and in about three quarters of an hour it started in to snow. Snow—it was a blizzard. I never saw anything like the way it swirled around us. We had been flying up a valley, mountains on both sides, and when this snow shut in you couldn't see them. Boonstra went right down to within a couple of hundred feet of the ground. He was looking for a field where he had made a forced landing two years before.

How he found it I don't know, because he certainly couldn't see it. It must be the same sort of instinct that brings migrating birds back to the same place year after year. We started circling around. No chance to tell which way the wind was blowing. Snow whirled all around us. Once in a while we could catch a glimpse of a man on the ground. He caught the idea presently for he extended both arms and then waved the windward arm forward, something like the crawl stroke in swimming.

The field was plenty long enough, but there was a snow covered haystack at one end. It looked as high as the Wrigley Building, but might have been a few feet shorter. The trouble was that it was a disappearing haystack. One minute you could see it and the next minute it was gone. Never mind, with the exhibition of flying that Boonstra had already given us, neither of us had any doubts about the landing.

Down we went, and a good landing on the property of Arthur J. Cheeseborough, who seems to own most of the country around here. It is called Elk Mountain. Mr. Cheeseborough fed us and warmed us until the snow was over.

By 3:00 P. M. it was clear and a crowd had gathered, about all the inhabitants of Elk Mountain, as you can judge by the photograph.

Off we jumped, over more mountains and then a stretch of fairly flat country. Boonstra was trying to save time and make up some of the time lost in the Elk Mountain landing, so he decided to land at Cherokee for gas. There is an emergency field there and we landed at 3:30. We helped the old caretaker and his wife gas up the ship and took off twenty minutes later. Cold, and windy? you never felt anything like it. We would have liked to stay and visit for a while. Sometimes these emergency field caretakers do not see anyone for weeks on end.

At 7:00 P. M. we arrived at Salt Lake City. There are no beacons on the line west of here so they do not fly at night. Boonstra took us to the hotel and we certainly put in a good night's rest. The only trouble is leaving so early in the morning.

The field manager called for us before seven o'clock in his model T (ground style—not air) and at 7:05 we took off, with Bob Ellis piloting.

We held another hill-hopping contest for two hours and landed at Elko, Nevada. We had passed over the Great Salt Lake Desert, which is nothing but a bunch of muddy ground blown clean.

(*Continued on page 92*)

Mental Cure for Vertigo

By George K. Spencer

Captain David Myers, with ex-Chief of Army Flight Surgeons, Col. Truby; Captain William Ocker in the plane.

A CONTRIBUTION to the science of biology which explains the deaths of thousands of persons in industry and many in aircraft operations by so-called "accidents," which guarantees the safe flying of military and commercial aircraft through fog and without the necessity for sighting the ground or skies enroute, is announced by Captains William Ocker, oldest line flying officer of the Army, and David Myers, senior flight surgeon at Crissy Field, San Francisco.

The separate discoveries of these two officers, the result of more than eight years of study, were not of great importance individually, but within the last year fate brought them to serve at the same air corps station, and accident revealed their findings to each other, the result being that a method has been devised for separating all the varied reactions of the fundamental flight sense in the human head, ending in the discovery of mental guards against seasickness and vertigo in the air. Furthermore, and this was originally the sole purpose of their work, means have been discovered for coordinating the human brain to the action of instruments which may be placed in any airplane cockpit.

When we consider that aircraft today must suspend flight in the presence of extensive fog, thus occasioning an economic waste almost daily in some part of the world, it can be understood just how valuable these discoveries will be to the air world.

Scientists in Germany, France, England and Italy have been concentrating on this problem for several years, and already they are on the verge of arriving at the solution; but the two American Air Corps officers are the first to make the announcement. They have invented no new instruments and have nothing to sell, though Captain Ocker has evolved and presented for patent an addition to the familiar Jones-Barany aircraft testing chair which will enable flight surgeons to explain to aspiring pilots just how to auto-hypnotize themselves to become a part of certain recently evolved aircraft instruments which at present are being used merely as indicators.

Air pilots have frequently come spinning out of clouds and fog, to go to the ground in a crash. It has been generally stated that they had lost control of their planes. In most cases this was not the entire truth, as indicated in deliberate spins made in fog at great heights by Captains Ocker and Myers during their testing of their flying system. The pilots who died believed firmly they were on a safe and proper course. The vestibular, or semi-circular canals in their heads were deluding them to death.

The Ocker-Myers system definitely proves that no man on earth or sea or in the sky can safely believe what the vestibular canals tell his brain. If an air pilot enters extensive fog, losing his ability to see objects on earth or in the sky, or if a mechanic in a factory suddenly finds his eyes caught by a quickly revolving flywheel and loses his balance, he is being deluded to death. A simple test of the vestibular canals was evolved by the two captains so that any man or woman who reads this need have no expensive apparatus to convince himself or herself of the danger to life which has been hitherto unsolved in a scientific sense.

Place your right hand on your left knee and your left arm pointed straight ahead. You are in a bending position now. Now have somebody turn you seven times quickly as you pivot on your feet. All this time your eyes must be closed tightly or blindfolded. Suddenly stop pivoting, and, half-unbending but retaining your right hand on the left knee, try to advance straight ahead and take a book from a chair or table. You will try to reach that book, but though every muscle in you forces itself to help you, you cannot reach

it. Instead you go careening off to the left or right.

Suppose you are in an aircraft. You are flying through fog, with every sight of earth and sky obliterated. Suddenly you feel you are turning to the right. Let us assume the fog is restricted and you come flying out of it. You find that while your brain told you that you were turning to the right, you are actually turning to the left! Assume that the fog were interminable and you found it impossible to get out of it. What then? Naturally, you correct your plane to fly straight ahead if you think you're going off your course to the right. This intensifies the illusion and you enter a spin. You still think you are moving right and you control to the left yet more. The spin becomes dizzier, the effect cumulative, and every move you make is an unwitting one toward disaster.

Subject taking Ocker-Myers convincing test. Box side removed.

For the first time, I am permitted to say here that Lieutenants Maitland and Hegenberger utilized the Ocker-Myers system in their flight to Hawaii, after confidentially being instructed in it at Crissy Field. The success of their flight, by their written statement, was due to this system. Why should they make such a statement? Because, every plane which flew from San Francisco to Hawaii, or attempted the flight, entered an area about 600 miles off the coast of the United States in which frequent spins were unavoidably made in dense fog areas. It is caused by the warm Japan current encountering the edge of the northerly moving and colder trade winds. Fog is rising from this area continually, at some times thicker and more extensive than at others.

All the trans-Atlantic pilots report one or more spins enroute from America to Europe. Luckily, these were made under conditions wherein the pilot could sight either the sea or at least a star in the sky by which the human eye could be re-oriented. Suppose all these spins occurred in dense fog. Almost certainly, except in the case of Lindbergh, who made a motion picture film of his instruments reacting in experimental spins at the factory, they would have died owing to the phenomena of vertigo. Each of these planes carried the key instrument of the Ocker-Myers system—the bank-and-turn indicator; but these instruments are at present being used much in the fashion we use the instruments on our automobile dashboard—as indicators. To secure positive safety, we must make them a part of our brains by a simple process of auto-hypnosis. The instrument must be believed and obeyed though every sense in our bodies tells us we are doing something else.

All the Wright Whirlwind motors used by the trans-oceanic pilots were good motors, with hours of test behind them. Of the entire group, it is possible one motor failed; but even that is a most remote contingency.

The City of Dallas, flying from San Francisco to Hawaii, reaches a point 600 miles off the American coast. Its radio announces, "We are in a spin. The fog is dense, we can see nothing." "We are again in a spin." "Belay that, we came out o. k." "We are in another spin—S.O.S." That was the end.

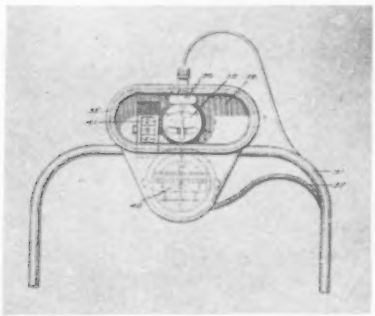
Captain Ocker and Captain Myers declare the second and third spins were sheer illusions. They took their plane in fog above Crissy Field and deliberately threw it into a spin and then flew by their senses. When their altimeters read less than a thousands feet, they began flying by their instruments again and came safely down with instrumental guidance.

"It is my opinion," stated Pilot Martin Jensen, who piloted the Aloha to Hawaii, "that the City of Dallas, the Miss Doran and Old Glory, as well as Nungesser and Coli, had similar difficulties and were unfortunate in not getting straightened out.

"In my flight, I went in a double spin in dense fog and, though I know instrument flying quite well, I suddenly felt my undercarriage clipping water. I quickly glanced out, saw unmistakable black sea waves and was merely lucky in pulling back the stick in time to go up from the sea. I was at the doors of death, positively.

"I doubted the instruments. Every instinctive pilot will do that. But

I learned that they were correct and flew the remainder of the way to Hawaii solely by instruments. I consider the Ocker-Myers system would have saved me my experience and would have saved the lives of many who have died."



Head-piece for Jones-Barany chair.

In three years five air mail pilots have died in precisely the same spins. This was loss of life, but the Air Mail (Transcontinental) has suffered a heavy loss in planes from the same cause. Private operators of aircraft could not afford the loss of planes such as occurred in the series of crashes at and near Chicago last spring when mail planes arrived to find the ground hidden by dense fog and the pilots, running out of gas had to jump in their parachutes.

As this is written, two British pilots, attempting to fly from Croydon airport, near London, to India, have landed in Poland, far off their course. In fog, with ice piling on their plane, and their limbs all but frozen, the pilots claimed that, though they saved their lives it was only due to a British variation of the American bank-and-turn indicator. With the Ocker-Myers flying system, they also would have reached India, had their motors and fuel held out.

It must be remembered that up to now, all flying services both military and commercial, have desired the so-called instinctive pilot. Without decrying this attitude, Captains Ocker and Myers have enabled the instinctive flyers to push back the horizons of instinct, add to their instincts, for the instruments grouped by the two Air Corps officers are designed to help the instinctive flyer fly still more instinctively. But they cannot and must not depend on their instincts alone.

What pure instinctive flying will do is best portrayed by the Air Mail pilot who recently tried to land in a dense fog in Colorado only to find that every time he would swing down to make his landing some force seemed to grasp his plane and pull it backward, the moment he cut down his motor to come in. Seven times he tried to land and each time this mysterious force pulled his plane backward.

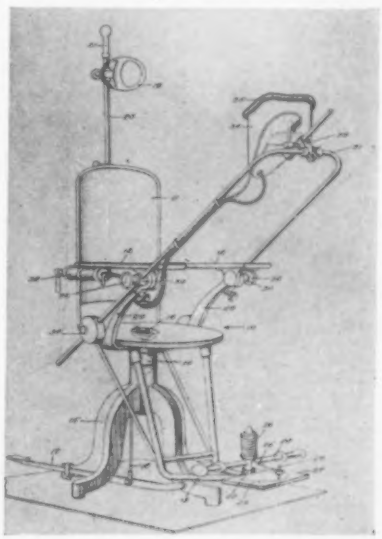
Then the fog lifted slightly to reveal that he was flying straight up the side of a precipice several thousand feet high, and each time he cut his motor gravitation started to pull him down to the valley below. Had he ever completely cut his motor, as he often did on landing, he would have crashed backward.

So long as some object can be seen, which will inform the pilot just where the earth is in relation to himself, he will not suffer such a delusion, which even the birds of the air must combat. In pursuing their researches, Captains Ocker and Myers discovered that even the birds of the air suffer the same limitations as humans, and that though they have developed their instincts to a higher degree in flying, the moment they lose sight of earth or sky in dense fog, they fly erratically.

This is easily proven by walking along any beach the morning after a night of great fog, when the fog extends from the surface of the earth to a considerable height. Dozens of birds, even sea-gulls, may be found dead on the beach, crushed as they fly into the earth from aloft, in their vertigo.

It seems that the instruments of man may yet achieve flights superior to that of the birds. We began in the early days of aeronautics by studying the birds. The Wright brothers did so, also A. V. Roe, England's pioneer, Cody, Lilienthal and Langley. We apparently are preparing to surpass the birds in the art of flying. With the Ocker-Myers system, allied with the better organization of airways and airfields, planes may take off in fog and fly to their destinations in fog, then land in fog, without any one on the machines viewing the ground.

Captain David A. Myers



The addition of the Ocker device to the Jones-Barany testing chair.

Contrast this condition with the present, when the chief fear of a pilot is fog. The first possible landing place is always sought out when a pilot finds himself moving into fog. He always will land when ice begins to pile up on wings, struts and fuselage, if he cannot melt it by coming to a lower altitude. If a pilot finds himself in fog which he can neither fly under nor over, the most frequent resort is to the parachute—and it is not always safe to descend by the parachute route. Before resorting to the 'chute, the pilot feverishly seeks to "feel" for the ground,

coming lower and lower. There are instances recorded by the air mail wherein the pilots actually clipped the upper branches of trees and narrowly averted crashing headlong into buildings on the earth while so feeling for the ground. Their speed in this process is about ninety miles an hour. The mail pilots, in order to save the mail, will take longer

The use of the device in testing perceptions.

chances before resorting to their parachutes.

It is as bad at sea with the Navy, for the sea is as hard as concrete to a plane coming down at ninety miles an hour. Generally one wing hits first, because no pilot can fly absolutely level in fog. The one wing is naturally clipped off the moment it hits the sea. The plane is pulled into the water; the propeller, still turning, drives it still further.

The Ocker-Myers system is endorsed under written signatures by such authorities as Dr. Isaac Jones, the greatest equilibrium specialist and author, and examiner of pilots for the Department of Commerce, and by Professor Albert Merrill, of the School of Aeronautics, Guggenheim Foundation, California Technological School, and many prominent air officers. The Chief Flight Surgeon of the Army Air Corps now has in his possession the Ocker device for instructing pilots just how to use their instruments to make these results possible.

An actual landing has experimentally been made under most unfavorable conditions in fog which offered no ceiling. That is, it extended down to the earth's surface. The landing was effected with the Ocker-Myers system by Pilot J. L. Rutledge, of the Pacific Air Transport Company, an airmail pilot flying the greatest fog route in the world, that between San Francisco and Seattle. The pilots of this line were the first commercial organization to use the Ocker-Myers system. By general order from the superintendent of service, every pilot flies by this system. Sometimes they take off in fog so dense that they have to place amber railroad flares every few feet to guide the plane getting off. They do not as yet habitually land in fog, but believe they will get to it in the very near future, with the better organization of the coast airways.

The Ocker-Myers system teaches that if a pilot or passenger will concentrate on the bank-and-turn indicator the moment the plane enters fog, and resolutely believes the instrument, though one's senses tells him something entirely different is happening, he will find that not only will he fly correctly, but that air sickness will be prevented.

Captain Myers determined that the sense of balance is not located in the inner ears alone, but that the eyes and the muscle sense also contributed to the balancing of the human body. The inner ear and the eyes, or any two of the components of the balancing function, provided one of the components is that of sight, are sufficient to enable the body to balance itself. Sight, however, is the one element which is imperative. Without it, no pilot can keep an airplane on its course. It will veer far to port or starboard and go into a crash, as previously explained in this article.

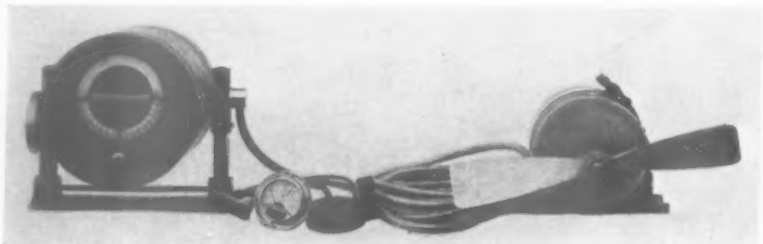
To take the place of the natural horizon, Captain Ocker places three instruments of precision in a compact group before the pilot. One at least will be for the first time publicly explained here.

The three instruments to be added to the human brain, to form an artificial horizon for the eyes to gaze upon, are the bank-and-turn indicator, the capacity altimeter and the air-speed meter. An inclinometer, which tells a pilot whether his nose or tail is pointed upward, is also of value.

We will now portray the proper conditions both within the plane and along the airway, which should prevail for the safety of blind flight. Considering the vast safety network built around the railroads, it would seem that aviation should not be judged as to its future efficiency until similar systems are constructed for the airways.

In the plane, bright lights illuminate the instrument board. The instruments named above are in one group. A little apart, another group of instruments tell the condition of the motor, fuel and lubricants. Another group denotes the activity of the radio, for all liners of the air should carry radio. This excepts only planes operating immediately in the vicinity of fields for training, sport or other purposes.

The instruments named above are electrically heated so that moisture may not gather and freeze on them.

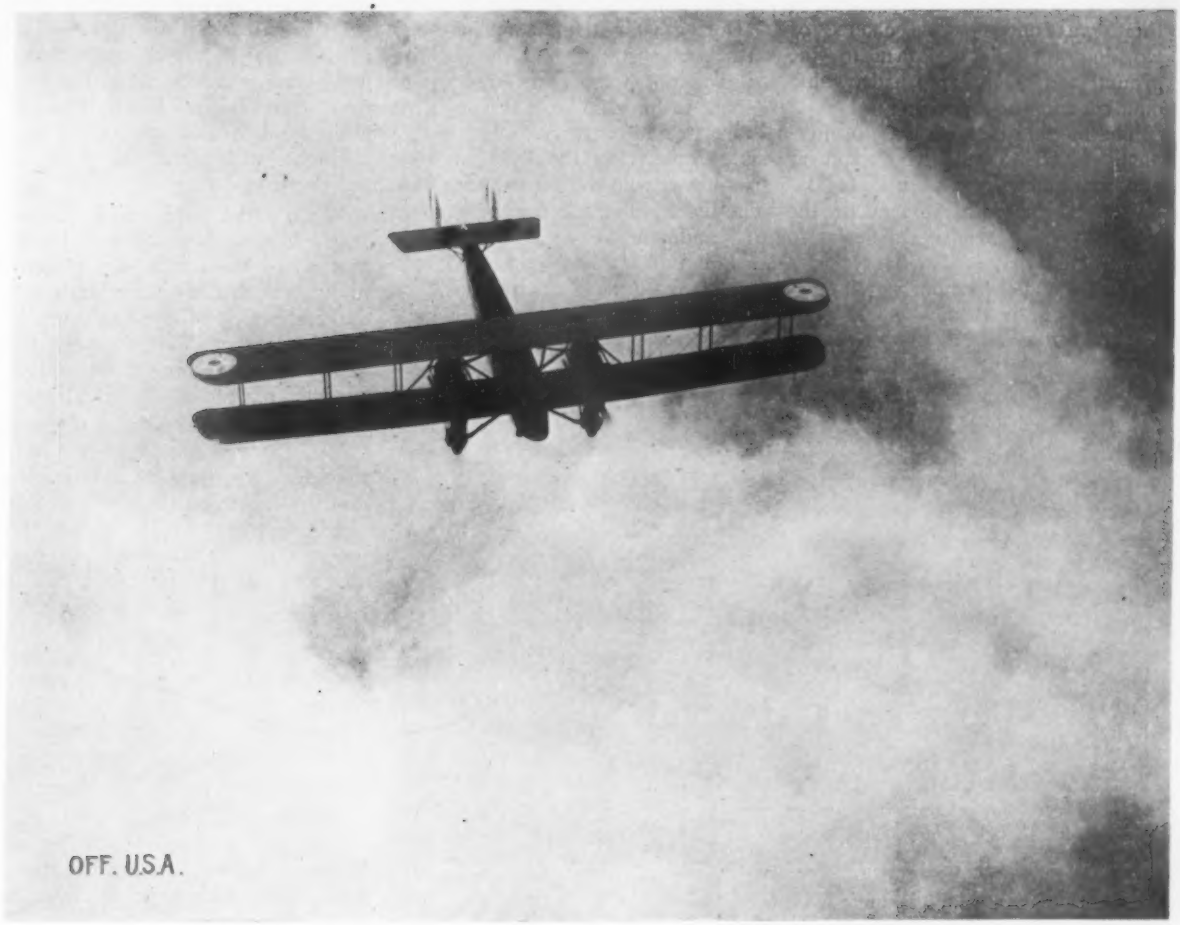


German Bank and Turn Indicator loaned the Air Corps in exchange for Ockner-Myers information for the German air lines.

The Ocker-Myers pilots take off from their home field with their passengers. All over their field, to a height of 24 feet, the fog is constantly being broken up and dissipated by the new system of dissipation, developed in embryo by the Navy. Amber lights, of fog-piercing character, illuminate the field.

It is night, and the dark adds to the blindness of the fog. Within the plane, the passengers and crew are comfortable and warm. The pilot and assistant pilot, their heads down

(*Continued on page* 80)



"Don't Give Up the Ship!"

By Falk Harmel

THERE have been numerous stories in newspapers and magazines regarding the "Caterpillar Club," that mythical exclusive organization of airmen who saved their lives through parachute jumps. If the intimate experiences of most of these "Caterpillar Club" members were compiled and printed in book form, that volume would most certainly tend to confirm the well-known assertion that "Truth is stranger than fiction." And yet there are stories of the adventures of intrepid airmen which are just as exciting, if not more so, than those which were penned by the "Caterpillars." They are stories of men whose lives became imperiled in the air and who, through coolness and great skill in the extreme emergency, managed to foil the Grim Reaper. Some of these men were not so fortunate as to be equipped with the parachute, while others refrained from using it, not through lack of confidence in it, but because, like the true Captains they were, they refused to leave their ship when the lives of others hung in the balance.

There were a lot of puzzled pilots and mechanics at Langley Field, Va. Their ears had been greeted by the spasmodic roar of airplane engines overhead going at full blast, and they ran out of their hangars or quarters to see what it was all about. Looking up they saw a twin-engined bombing plane hovering overhead at an altitude of about 1,000 feet. The eccentric behavior of the engines told them that the pilot was in some sort of trouble, the nature of which they could not fathom. Riveting their eyes on the giant plane, they watched it gradually lose altitude until it was about 30 feet off the ground, when the pilot levelled it off, cut the switches, and allowed it to drop to the ground. In this short drop no one was injured.

What really happened was that when the pilot started to make a landing, he found that he had lost the vertical control of his plane—a very serious situation, for once the plane starts to nose down the chances of avoiding a serious crash are very slim, indeed. Neither the pilot nor the two mechanics who were with him on the flight were equipped with parachutes. They were not in general use at the time of this incident.

Far from resigning himself to the inevitable, the pilot set his wits at work to find some way of extricating his two passengers and himself from their unhappy plight. He found that

there was one possible chance of working the plane down to the ground and he imitated a drowning man catching at a straw.

The method he used was to alternately switch the engines on and off and manipulate the adjustable stabilizer, a horizontal surface of the tail unit which in large planes is so constructed that it can be set at a variable angle, rendering it unnecessary to hold the control stick

in a certain position to compensate for the load carried. Throttling his engines, he told one of his mechanics to handle them and to apply full or reduced power at a certain signal from him. Fortunately, the lateral control of the bomber was still intact, and by operating the control stick and the adjustable stabilizer, the trailing edge of which is moved upward or downward by means of a control cable operated in the pilot's cockpit, the nose of the airplane was held up until it began to stall. At this point the two engines were turned on full force, in order to hold the nose of the plane above the horizontal and enable the pilot to manipulate his adjustable stabilizer to bring the plane back to a level position. When this was accomplished the engines were again throttled and remained so until the plane stalled again. Through these tedious maneuvers the bomber gradually lost altitude until it was 30 feet off the ground. In reaching the ground safely the pilot accomplished a most unusual feat, calling for coolness and great skill.

During a night flight not long ago in a transport plane in the vicinity of Dayton, Ohio, an Army pilot "stuck to his ship" and, through his coolness and bravery, was responsible for saving the lives of four passengers who were flying with him. The flight was made for the purpose of conducting experiments with a certain type of bomb attached to a small parachute. The pilot was in the front cockpit, his four passengers in the cabin, and one of them was engaged in the task of dropping the bombs through an aperture in the floor of the cabin. Normally, a time fuse automatically explodes the bomb when at a distance of about 600 feet behind the carrying plane. The first bomb, released when the plane was at an altitude of about 1,300 feet, exploded prematurely about ten feet under the ship near its tail. The flash temporarily blinded all the occupants on board. The pilot immediately realized that his elevator control was seriously affected, and he was forced to use all the strength of his knees and arms to hold the controls forward and keep the plane in flying position. Knowing that the plane was badly damaged, he endeavored to warn his passengers to take to their parachutes. Being unable, however to obtain immediate communication with them, he concentrated his energies toward making as safe a landing as was possible. After further testing his controls he found that there was a chance of bringing the plane and all on board to earth in safety. So skillfully did he maneuver the damaged craft that a good landing was made in the darkness on Wright Field, Fairfield, Ohio, with the aid only of the landing lights with which the plane was equipped.

When the imperiled airmen reached terra firma it was learned that all of them had been prepared to jump with their parachutes after the first shock of the explosion but refrained from doing so when they saw the pilot sitting tight and apparently master of the situation.

An examination of the plane revealed that various wooden ribs in the wings were broken and detached, and the fabric on the bottom of the fuselage was torn to shreds and loosened on the tail, wings and other surfaces. It was fortunate that the vital parts of the transport were of duralumin construction, and while some of the bracings were badly bent, retarding the lifting power and elevator control, the plane still held intact. Had this plane been of wooden construction throughout, a different story would have been told.

Rather than jump with his parachute and permit his burning airplane to fall in the city of Springfield, Ohio, and cause a serious fire and, perhaps, deaths, an Army pilot placed his own life in jeopardy by sticking to his ship. Throttling his engine, he glided the plane to an open space on the edge of the city and landed it. He then jumped out and completed the extinction of the fire by rubbing his gloves along the burning fabric of the fuselage, burning his hands slightly in the process. The fire in the air was caused when a broken connecting rod punched a large hole in the crankcase of the engine, permitting gasoline and oil to spurt all over the plane. The gasoline coming in contact with the hot engine started the conflagration. The airman afterwards stated that while he had utter confidence in his parachute, he feared the consequences following the abandonment of his burning plane while over the heart of the city.

At Chanute Field, Rantoul, Ill., where the Air Corps Technical School is located, officers and enlisted men are taught the art of parachute jumping, in consequence of which numerous practice jumps are made there. Missing his footing

while about to step forth from the fuselage of an airplane to make a live parachute jump, an enlisted man's fall through space was intercepted when the rip cord (the parachute releasing device) caught on a projection in the plane, resulting in the chute opening, blowing to the rear and becoming entangled in the tail group. This served to render the controls of the plane useless and it was only a question of a short time before the plane would stall and fall into a tail spin. A serious accident was narrowly averted through the coolness and presence of mind of the pilot in sitting tight until again able to use his controls, and his skillful handling of the plane thereafter.

When the parachute fouled the rear control wires, a buckle of the jumper's parachute harness fastened itself on one of them. The weight of his body, hanging solely from this control wire, caused the airplane to fly almost vertically upward, and a stall seemed imminent. The extreme angle at which the ship was then flying and the rush of air from the whirling propeller slid the imperiled parachute jumper down to the tail of the plane along the wire from which he hung. This man, like his pilot, kept his wits about him. Grasping the diagonal strut bracing the stabilizer, located beneath the tail surfaces of the plane, and supporting his weight on it with both feet and one hand, he managed with his other hand to practically disentangle the parachute from the control wires, and the pilot was thus enabled to again manipulate his control stick. The enlisted man retained his none too comfortable position until released by the pilot after the plane landed, the pertinacious buckle refusing to let him go. The pilot had lost no time in bringing the plane to the ground, and he landed so lightly that his passenger, despite his perilous position, was uninjured. The pilot afterwards stated that the plane zoomed about a thousand feet before it was brought under control.

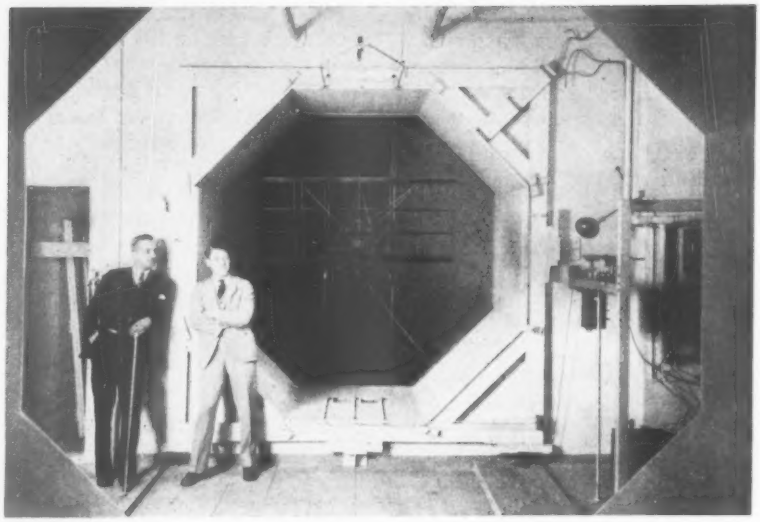
A Kelly Field pilot, flying a certain type of monoplane, went through a most trying experience before he reached terra firma again. Flying at about 5,000 feet altitude and at a speed averaging about 135 miles an hour, his control stick suddenly began cutting some queer capers. Wrenching itself free from the pilot's hand it struck his left leg, knocking his foot off the rudder bar. Then, whipping across the cockpit, it performed the same operation on his right foot. Following this it vibrated rapidly for several seconds and, seeming to give up the ghost, fell loosely against the left side of the cockpit. To add to the pilot's uneasiness, the wings started to flutter. Testing the elevators and finding the response normal, he tried to eliminate the fluttering, which was rapidly becoming worse, by climbing the plane and then skidding it. This having no effect, the pilot's decision to jump with his parachute was strengthened by the sight of pieces of aileron flying about him. Standing up in the cockpit, he pulled the stick back and brought the plane up to a stall. Just as he was about to jump the wing fluttering ceased and, thinking there was a chance of getting down without crashing, he resumed his seat and tried to turn back towards Kelly Field. The moment the plane was turned to the right, however, it pitched over into a spin. All his efforts to right the plane being in vain, he opened the motor wide and, while this served to start the wings fluttering again, the speed of the plane produced sufficient air pressure on the rudder to enable him to force it out of the spin. To eliminate the wing fluttering he again throttled his engine, but the moment he did so he found himself in another spin.

By the time the pilot got out of the second spin he had lost considerable altitude, but gained a few pointers as to just what not to do. He avoided further wing fluttering and spins by flying at a speed below fifty miles an hour and keeping his plane constantly turning to the left. Picking a cane field off to his left he sideslipped in his final turn and made a normal landing. After rolling a short distance, so much of the cane was banked in front of the landing gear that the plane nosed over and landed on its back. The pilot crawled out, none the worse for his experience.

Not all the thrills of the flying profession are registered by the man handling the control stick. An Army pilot at Luke Field, Hawaii, scheduled to make a flight to Schofield Barracks, seized the opportunity to cart along some laundry to deliver to his favorite Chinaman. A sergeant was seated in the rear cockpit and the bag of laundry was placed in his care. On the take-off, however, the landing gear was wiped off, also part of the rudder, and at an altitude of 500 feet the plane became unmanageable. Down she dove towards the ground. The sergeant's thoughts were on his date that afternoon at the hotel, and a tear glistened in his eye. He pictured how his manly features were about to be scratched by the algeroba patch below. Just before the crash a bright idea flashed through his brain—the bag of laundry! He placed it in front of him

(*Continued on page* 90)

Another Airwise College



Entrance to testing chamber showing part of the apparatus used.

WHEN the University of Michigan's new wind tunnel was placed in operation recently the aeronautical department of the engineering college joined hands with the aircraft industry of Michigan and other states in promoting aerodynamical research and developing new types of planes and spreading the gospel of air transportation.

Aircraft manufacturers of Detroit and vicinity were quick to realize the possibilities of the equipment placed at their disposal for research in various aeronautical problems and at present members of the aeronautical staff, with the aid of students, are engaged in designing and testing several new planes which are to be placed in production at an early date.

The course in aeronautical engineering offered by the University of Michigan is complete with the exception of practical flight training. Arrangement for this training is made with the United States Navy through their special student training course offered each summer to the Navy Reserve at the various Naval Air stations.

The work in the aeronautical department under the direction of Profs. F. W. Pawlowski, Edward A. Stalker, and L. V. Kerber, has been arranged to cover all problems entering into the design and construction of airplane and other types of aircraft. Two main types are studied: heavier-than-air and lighter-than-air craft. In the first class, a study of the general question of aerodynamics, problems relating to lift and drag of various types of wing sections, the determination of stresses and general design of structure for all parts on an aircraft and the design of propellers and propelling machinery is undertaken.

In the lighter-than-air craft class, all studies mentioned above are taken up with special reference to dirigibles and balloons and their navigation.

The courses offered by the aeronautical department are arranged to cover the essentials of aerodynamics necessary for the proper understanding of the action of wings and propellers and problems connected with stability and maneuvering. These courses form the basis for the application of such studies to the design, construction and analysis of performance of all types of aircraft.

As a preparation for courses in aerodynamic theory, certain preparatory studies are required of the aeronautical engineer. These comprise the usual mathematics, courses in theory of structures and mechanical engineering, including gas engine design and hydromechanics.

The wind tunnel offers facilities for experimental work in all problems relating to aerodynamics and is available for special research work by advanced students in the department. The university's tunnel is the first to make use of the double return duct system by which air currents with speeds up to 200 miles per hour may be attained.

What the tunnel means to aircraft manufacturers is explained by Prof. Stalker:

"An experimental plane costing approximately $40,000 may be constructed after months of planning and after a single flight it may be found that the ship is unstable and fit only for junk," Prof. Stalker said. "Then, too, loss of life may be entailed in the flight test of the new plane.

"By using the wind tunnel a small model of the ship designed in detail to represent the finished plane may be tested in the air stream set up in the tunnel and, by means of a system of balances and scales, lift and drag and other dynamical characteristics may be at once determined. If correction in design is needed this may be done at small expense and new tests made. Then when the model is pronounced stable and measures up to standards the full size ship may be constructed and flown with assurance that it is airworthy.

"When manufacturers of aircraft realized that for as little as $100 such tests could be made of their models in the University of Michigan tunnel, they were quick to take advantage of the offer."

The tunnel is valued at approximately $138,000. The Daniel F. Guggenheim Fund for the Promotion of Aeronautics last year gave the University of Michigan $28,000 to complete the tunnel and to provide equipment for its operation. With the necessary workshops, laboratories and apparatus, the wind tunnel has a replacement value of $150,000.

At one end of the central duct is the large propeller which pulls the

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air through this duct at varying speeds according to the opening at the throat of the tunnel and returns it via the two outside ducts. The central chamber as well as the two outer ducts are finished in white enamel to eliminate resistance to the passage of the air stream.

The revolving propeller draws the air towards it from the central chamber called the "Eifel" chamber, and sends it back through the outside ducts. As the air is drawn past the model suspended in the middle of the wind stream it causes the small plane or wing section to behave much as it would if it were actually being propelled through the air. Records are kept of its behavior and from this data certain aerodynamical characteristics are determined and the design of the plane or airfoil is thus checked.

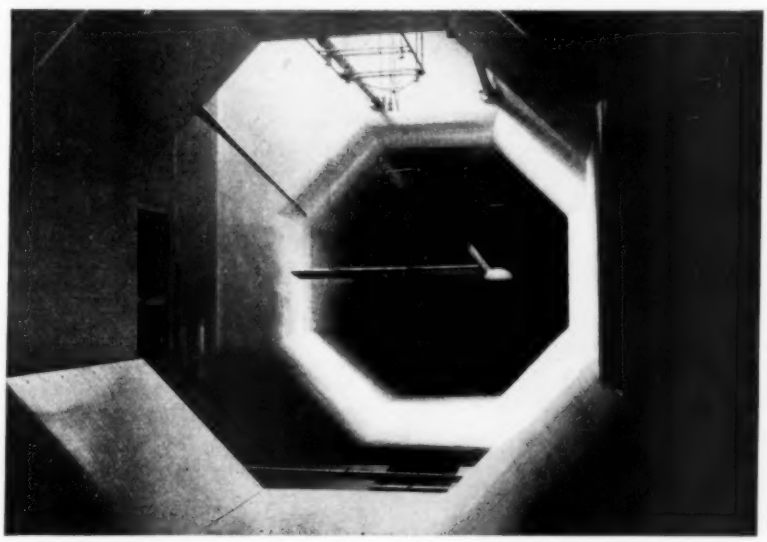
The model craft is suspended in the Eifel Chamber by stream lined wires which are connected with scales and balances on the platform directly above the chamber. The angle of attack of the plane is controlled electrically and the model is lined up by means of transits. A Pitot tube much the same as those used on actual planes is placed in the air stream to conduct air to the air speed indicator which indicates the speed the model is supposed to be traveling in relation to the passage of the air column.

Between the Eifel chamber and the propeller is stretched a wire screen to prevent any objects being sucked into the whirling prop. The end of each wire in the mesh is attached to a spring as the wire net would break if the wires were taut and an object should strike it.

Entrance to the tunnel is barred during the progress of tests on a model as eddies and back drafts would be set up if someone were to walk through the outer ducts while the air was being drawn swiftly through them. A system of telephones has been installed in the university tunnel to allow messages to be conveyed from the outside to the inside of the tunnel while the tunnel is operating and to notify the operators inside that entrance is desired.

A course in wind tunnel testing is to be offered advanced students in aeronautics according to Prof. F. W. Pawlowski, technical head of the department. Those students who desire to work out ideas of their own will be encouraged to do so, Prof. Pawlowski said. Members of the aeronautical faculty are permitted to conduct these tests of designs for new planes and other aircraft in the tunnel. Manufacturers of aircraft present their problems for solution through the Department of Engineering Research of the University of Michigan.

E. N. Fales, consulting aeronautical engineer and former head of the United States Air Service Aerodynamical Laboratories at McCook Field, Dayton, joined the aeronautical staff here recently and is now engaged in perfecting the wind tunnel and equipment. He will be in charge of aerodynamical tests for the aeronautical department for the aircraft industries of the state. Mr. Fale's appointment was made possible through the Guggenheim Fund. He is a graduate of the Massachusetts Institute of Technology and has had more than ten years experience with the Government Air Service.



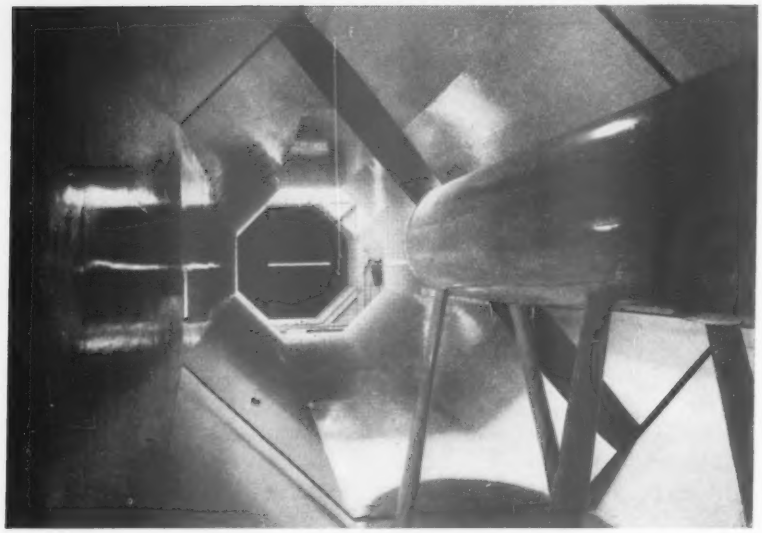
The Eifel Chamber of the Wind Tunnel at the University of Michigan.

John D. Ackerman, a graduate of the Imperial Technical High School of Moscow, and a wartime ace with the French and Italian armies, is a member of the aeronautical staff. Mr. Ackerman is responsible for the design of many of the recording instruments in the tunnel and is completing a design for a "propeller dynamometer" which is to be constructed for use in the tunnel.

By using this new dynamometer, Mr. Ackerman proposes to measure propeller efficiency. The motor, gears, and essential parts for building the instrument have been ordered and the machine is to be assembled in the aeronautical shops. Aircraft manufacturers have agreed to furnish much of the necessary material for its construction at cost.

For students taking aeronautical courses facilities are provided in various other laboratories of the engineering college for special investigations of strength of materials, and parts of aircraft structure, motor testing and comparative study of resistance of bodies in the naval tank. Also studies of aerodynamical properties of various bodies and airfoils are made in a special tunnel where an air current three feet in diameter with a velocity of 40 miles per hour is used in connection with two dynamometers. One dynamometer is of the type for a simultaneous determination of lift, drag and center of pressure of airfoils; the other for the determination of thrust and torque of propeller models two feet in diameter.

Combined courses have been arranged with Albion and Olivet colleges to permit students to take the first two years of their work at these institutions before entering the University of Michigan to complete the requirements for the degree of Bachelor of Science in Aeronautical Engineering. The same arrangement



Aerofoil section hung in the Eifel chamber for test as viewed from the throat of the air duct. Propeller may be seen in the foreground.

is also maintained with the College of the City of Detroit.

One hundred and sixty-nine students are enrolled in the ground school course offered University of Michigan students by the United States Navy in connection with the Naval Aviation Reserve under the supervision of Lieuts. Charles D. Williams, Jr., and Louis R. Marshall, of Detroit.

Approximately one-half of this number are from the College of Literature, Science and Arts and the rest from the College of Engineering.

Weekly meetings are held on Thursday nights and a series of lectures on various phases of practical aeronautics are given the students. The subjects include: branches of navigation, uses of the compass, correction of compass courses, art of navigation in pilotage, navigation by dead reckoning, practical flying, aviation in doctrination, general navigation, aerology, theory of flight, structure and rigging of airplanes, scouting, airplane motors, radio, aircraft communication, instruments and regulations.

The instruction is given the ground school unit by members of the engineering faculty and officers of the Naval Reserve from Detroit. It is planned during this semester to give the students rides in Navy planes on week ends.

Elementary flight training is to be given those students who successfully pass the ground school course and the physical examination. Those who qualify are to receive a 45-day period of training during the summer at one of the active Naval Reserve Aviation units.

Advanced flight training will be given those students who complete the first period successfully and are pronounced fit for the advanced work. The advanced training will be given at the U. S. Naval Air Station, Hampton Roads, Va. Upon completion of this advanced training comprising qualification in more advanced types of aircraft, machine gunnery, bombing, photographing and scouting, the student candidate is commissioned and designated a Naval Reserve Aviator. To those who volunteer for the service, a year's active duty with the Aviation Squadrons of the Atlantic and Pacific fleets is offered. The student here receives two hours' credit for each semester's work completed.

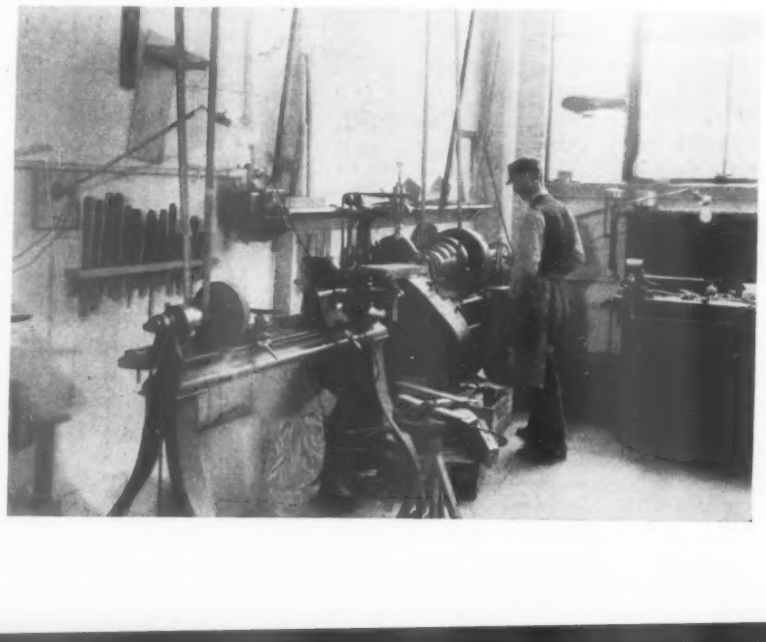
Prof. L. V. Kerber has recently issued a "Manual of Flight Test Procedure" which marks a step towards standardizing methods and procedure for determining with greater accuracy the performance of airplanes used in military, naval and commercial aviation in this country. The manual was produced in conjunction with W. F. Gerhardt, consulting aeronautical engineer and former chief of the flight test research unit, Material Division, United States Air Corps. Prof. Kerber was formerly chief of the aerodynamics unit, United State Air Corps, at Dayton, O. He is now the Guggenheim professor of Applied Aeronautics at the university here.

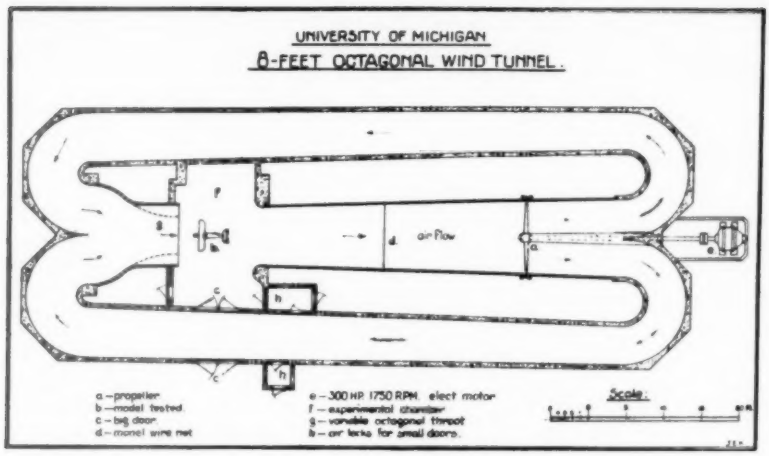
The manual embodies such subjects as: the general problem of flight testing, including production testing, preparation of the airplane for flight, actual flights, computation and reduction of data, research testing, improvement of design and testing procedure.

Testing procedure of the airplane as whole is outlined. The performance of the plane as affected by speed and the performance as affected by altitude or density is treated.

The various units of a plane, en-

Corner of the wood working and model shop used for making test models.





gine and propeller, are discussed and methods of testing given. The bulletin tells of the preparation of the new plane for actual flight, the installation of navigation instruments and their calibration.

Flight operations are outlined, including preliminary flights, airspeed calibration, climb and cooling test, operational characteristics—take-off and landing, balance and stability, maneuverability and control.

The speed of best rate of climb, the true rate of climb, high speeds, maximum angle of climb, engine revolutions, engine power at high altitudes, minimum rate of descent, minimum angle of descent, and propulsive efficiency are among the various phases of testing procedure discussed.

Mr. Gerhardt and Prof. Kerber obtained permission to include in the manual material resulting from research and experience during their official connection with the Air Corps.

The manual is intended to be of service to two groups of readers: first, members of the air services not directly engaged in flight testing and others in the industry desirous of learning how test results may be obtained; and, second, specialists in designing and testing who may be able to contribute constructive suggestions based on their criticism of present proposed procedure.

Three New Wrights

THE Wright Aeronautical Corporation, according to a statement from Guy Vaughan, vice-president and general manager, will produce three new power units for aircraft use. The engines, so far unnamed, will offer manufacturers a range in power from the 140 horsepower unit to the 300 horsepower unit.

As far as possible the parts of each of the three power plants will be interchangeable. The engine mounts will be identical, so that a manufacturer may design an airplane with a standard mount ring to take care of any one of the three power units. This mount will have the same base as now used for the Wright 225 horsepower Whirlwind.

The 140 horsepower engine will provide manufacturers of the lighter commercial planes with an air cooled unit suitable for their planes, yet with a reserve of power in excess of the requirements of design. The new 200 horsepower engine will eventually replace the present J-5 "Whirlwinds" without the necessity for any structural changes in the plane.

The new 300 horsepower engine makes it possible for manufacturers of planes used in heavy mail, express and commercial use, to offer a base design for a wide range of uses, without the necessity of redesign or additional stress analyses in case greater power is desired.

The Wright Aeronautical Corporation has erected a new building for assembly and test, and preparations for production on the new motors are under way. Deliveries will not be made until the spring of 1929.

Radio Direction Finder

"Instrument flying" of aircraft, by means of the visual airway direction finder developed at the U. S. Bureau of Standards, will, it is anticipated, set a new standard of regularity and safety in flying over air routes. The device, which is known, in short, as visible radio, resembles in appearance an ordinary compass. Its needle-like reed is moved by electrical impulses received from a radio beacon, and is located on the dashboard of the plane. Its function is to warn the pilot if he leaves his designated course for an instant. This instrument, according to the Bureau experts, does away with head phones and also eliminates the trailing wire antenna.

Final perfection of the device follows eight years of experimentation. The Bureau of Standards designed the directive radio beacon originally for the War Department and established the first of these beacon stations at McCook Field, Dayton, Ohio. There it was developed further by Army engineers. The old system required the pilot to listen to certain signals in order to judge whether he was on or off the course. The new system just announced uses a visual indicator eliminating all use of head phones, and is much less susceptible to interferences. This experimental work, although still in progress, was said to be sufficiently perfected so that a beginning can be made in practical everyday use of it in flying.

The only radio beacon station operating on the new system is the Bureau of Standards station at the College Park field, near Washington. Airplanes on the New York-Atlanta line are being equipped with receiving sets for this system, and will operate by its aid beginning May 1. At the same time it is expected that airplanes of the New York-Cleveland line will begin use of the same service from

(Continued on page 92)

Current Comment

Quotation

We get so eternally sick of the deprecating American who is always so ready to say "But Europe, of course, is far ahead of us in aviation"—that we welcome the opportunity to quote the following:

"What does it all mean? Does it mean that America is seven years behind us? Or does it mean, to use a somewhat far-stretched metaphor, that in England a paternal government has not only placed the cart in front of the horse, but engined it with a powerful subsidy; while, in America, the powers-that-be waited until the horse had found its feet and proper pathways, and then attached such a cart as seemed fit? The answer is in this Aircraft Year Book for it shows that not only is there a civil aviation in America which we all know, but that civil aviation is really an essential part of the American milieu, and that America once more has used her natural advantages to zoom ahead of her European competitors in the race for the empyrean of the aerial age. . . . Finally, as a last surprise, one learns that there are over 4,000 aerodromes in America. Of course, we know that statistics can be made to prove anything, but it seems to me, after a perusal of this Aircraft Year Book, issued by the Aeronautical Chamber of Commerce of America, that it would be a very clever statistician who could possibly prove, by any juggling of figures, that America was not miles ahead of us in civil aviation, just as she is miles ahead of us in the art of mass production and the possession of all the gold in the world."

This is from the English magazine "Airways," and we invite the attention of the above mentioned Americans to this viewpoint on our progress.

For Those Who Like Statistics

One of the commercial companies, engaging in teaching, cross country work, passenger flying and exhibition work, reports that in the past year they have flown a total of over a million passenger miles without injury to either pilots or passengers. This record is equal to flying one passenger from New York to San Francisco about 430 times. If you think that aviation has any more hazards than automobiling try running your car that many times between those two points without an injury to yourself or passengers. And, another thing, losses for the year work out to the sum of five cents per passenger mile. This offers some more food for thought.

Here's a Useful Bill

The Honorable Phil D. Swing, Member of the House of Representatives from the Eleventh District of California, has introduced a bill authorizing the use of the air mail service by members of Congress, the Executive Department, and independent offices of the government. The bill provides that air mail stamps be supplied those specified for official correspondence requiring expeditious transmission.

It is time for the Federal Government to take advantage of the service offered by the air mail. Such a course will have two effects. It will materially increase the revenue of the operating companies, and it will probably effect a material saving in the telegraph bills of Congress. At the present time official business is transacted by means of the expensive telegraph or the old and slow franked mail. The rapid increase of air mail poundage, as we are forever saying, is the quickest way to bring about a wider, more efficient, and better air transport system. The mail is the bread and butter of the operating companies. Once definitely assured they can turn to passenger operations on a larger and more comfortable scale. Write your Congressman at Washington in support of House Bill 12291. That will help.

Please Take Notice

One of the purposes of the All-American Aircraft Show is to offer the public some convincing proof that aviation as an industry is established and rapidly moving toward the goal attained by the other automotive industries. You cannot turn to the many pages of photographs of various craft shown in this issue without becoming aware of that fact and realizing that this looked for future is just around the corner.

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Aviation Loses a Man of Vision

IN the death of Rodman Wanamaker, which occurred March 9, aviation lost one of the pioneer enthusiasts who gave generously of his time and money for the advancement of aeronautics.

As early as 1912 Mr. Wanamaker had the vision to see trans-Atlantic air transport. In the words of Guy Vaughan, vice-president of the Wright Aeronautical Corporation, "Mr. Wanamaker's efforts in those early days to organize a successful flight from America to Europe, which were held up by the World War, were a stimulus to all of us in the aeronautic industry."

Mr. Wanamaker was known chiefly for his construction of the America, the first flying boat, and his later backing of Commander Byrd's flight across the Atlantic in the second America. From the early days of flying he dreamed of the time when planes would fly regularly between the United States and Europe, and to bring that day closer he gave much of his time and hundreds of thousands of dollars in money.

Moved by patriotic impulse he saw in air communication one of the greatest methods for the establishment of close and more friendly relations with European countries, particularly France. He recognized aviation as one of the great means of binding the nations of the earth together in peace, and foresaw the effect such flights would have. That his vision was correct was proved by the receptions accorded to our trans - Atlantic flyers the past year.

Rodman Wanamaker

In 1909, when Glenn Curtiss won the international races in France Mr. Wanamaker exhibited the Curtiss machine in his store, where it was shown to thousands of people.

The first "America," which Mr. Wanamaker had built at a cost of over $200,000.

Mr. Wanamaker was chosen last year as a vice-president of the National Conference for the Development of Commercial Aviation, and acted as Mayor Walker's representative on Secretary Hoover's Committee to select a suitable site for a New York City airport.

Commander Richard E. Byrd says of him: "As for his contribution to aviation, he built the first big flying boat, the America, at a time when spending so much money on an experimental plane seemed foolhardy. But from that model all modern flying boats have come. The America was turned over to the English when the war started and was copied, and some of the first English flying boats were called the America model."

Porter Adams, president of the National Aeronautic Association, in a telegram to the children of Mr. Wanamaker, said, in part: "In the entire history of American Aviation no one has contributed more substantially or more unselfishly to its progress."

It is a gratifying thing that Mr. Wanamaker lived to see the fulfillment of his hopes and wishes and the proof that the airplane can become a messenger of peace as well as an engine of destruction; and it can be rightly said of him that he was the first to perceive that this country could send ambassadors of good will to the other nations of the world. It is an unhappy event that he will not be here when the first regular trans-Atlantic Air Service goes into operation, but we all know he had the vision.

Tricks Students into Landings

By Willis Parker

A NEW method of teaching students to land has been developed by Cloyd P. Clevenger, chief pilot and flying instructor of the Alexander Aircraft Company, Denver, Colo. The plan bids fair to cut instruction time by an hour or so and it is possible by it to teach landings earlier than usual.

"The big error that most students make when they first try to land," explained Mr. Clevenger, "is that of looking at the ground too close in front of the ship in ascertaining the distance they are above the ground. Another error is that of attempting to force the ship onto the ground instead of holding it off. The principle of landing is to come down to within a few feet of the ground, skim along parallel with the surface, and, as the ship loses speed, raise the nose higher and higher to keep it off the ground, yet, not quickly enough to zoom up and away from the ground. The ship eventually stalls and settles to the ground in spite of the pilot. Any landing before this point is premature and will result in a bounce unless it is a properly executed wheel landing.

"My new system suggests to the student that he is not to make a landing. I ask him to fly the entire length of the flying field at an altitude of twenty feet above the ground, and, under no circumstances, touch the ground. After reaching the end of the field, I have the student climb and fly around the course and then make another parallel flight across the field at a lesser distance above the ground.

"The elevation of the second flight across the field depends upon how near the student came to estimating his distance on the first flight. The chances are quite certain that he didn't estimate well. Instead of being twenty feet up, he may have been but fifteen. Then, again, he may have been twenty-five or thirty. At any rate, I govern my instructions according to the student's previous attempt, and if he was flying at fifteen feet instead of twenty, I ask him to fly at fifteen for the second flight, and the chances are nine to one that he'll be about ten feet off the ground.

"By the time the student has made three or four rounds, he is able to fly a fairly even and parallel course over the ground. The next round, as he is skimming over the ground, I gradually throttle the motor and reduce the air speed. If the ship begins to settle, I shake my head and the student pulls the nose high enough to prevent settling. At the end of the field I apply full gun and the student flies the course again. It is best to repeat this dose two or three rounds to get the student used to flying over the ground at a medium speed. Then, as a final stage, I gradually reduce the throttle until the ship has lost all flying speed and settles to the ground, in spite of what the student is doing to endeavor to fly the length of the field up above the earth. If the ship settles prematurely, the student, under this system, sees it settle, but advances the alibi that I throttled the motor and caused the ship to settle. Then I explain to him that he should have pulled the nose higher to stop the settling, and that his only job is to fly at that definite altitude above the ground regardless of what I do to the throttle.

Cloyd P. Clevenger

"On the next round the student will probably fly parallel to the ground until his air speed is entirely spent and the ship will make a good three-point landing.

"Naturally the student is surprised when he finds he is on the ground and at a standstill. His surprise comes from three sources. In the first place, he is surprised that he's on the ground. He's surprised in the second place because he isn't bawled out for doing something he should not have done. In the third place he is surprised and astonished at the smoothness of the landing.

"When the ship has been brought to a standstill, I have a talk with the student and impress upon him the fact that landings should be made in the same manner. I admit that I fooled him into making a good landing, but that if he is smart he will remember what he was trying to do when he made this good landing and can make good landings in the future in exactly the same manner.

"Then I have the student try to land. If he tries to accomplish it in just the same manner that he made his first, though surprise, landing, he'll make three-pointers nine times out of ten. If he starts zooming up and down when near the ground, he has forgotten about flying the length of the field, and is looking at the ground too close to the front of the nose. To correct this fault, it is necessary to repeat the entire dose of trips around the field, skimming over the ground without landing. If he seems to have the right idea and execution of flying parallel to the ground and of preventing the ship from settling, but still gets too close and bounces, I stop and ask him how high he thought he was skimming above the ground. Of course I know that he was but a few inches up and that is why he hit the wheels. He may say that he figured he was, for example, three feet up. Then I tell him to skim five feet on the next round and to come no closer than five feet. Thus, by getting the

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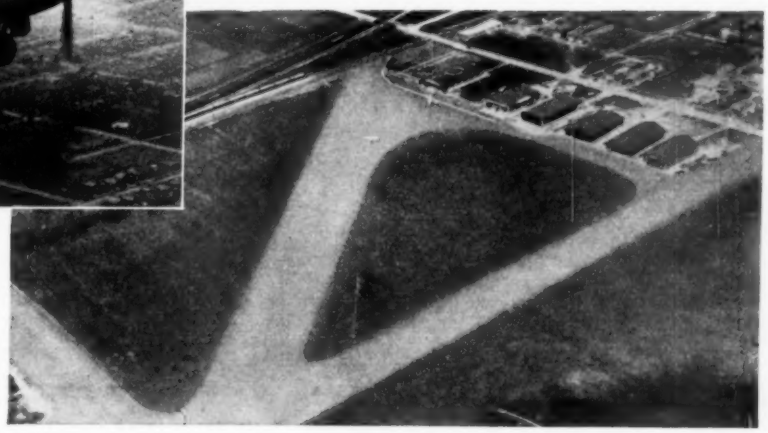

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student's viewpoint, I can adjust his conception of distances at which to skim over the field to my instructions.

"This method, of course, only concerns the flipper operation in landing instruction, having nothing to do with the levelling of the wings nor the correction of side drift. However, I can heartily recommend its use to simplify this difficult stage of instruction. But it is necessary to have the facilities of a large landing field to follow out the plan."

Airways Marking Convention

THE Chamber of Commerce of Wichita, Kansas, is offering $1,000 in prizes for the best and most practical suggestions for methods, systems and designs for the marking of airports and airways. These designs will be tested and the prizes awarded during the convention which will be held in Wichita, May 10 and 11.

Officials representing various branches of the government, representatives of aircraft and accesory manufacturers, pilots, officers of transport companies and enthusiasts will attend the convention, which is the first one to be held for this specific purpose. Government officials, famous pilots, and representatives of aeronautical organizations will be the board of judges for the awarding of the prizes.

Direction and distance marker to show course and miles to nearest airport as sent in by one contestant.

The recent conference of commercial airplane manufacturers which met in Wichita formed a branch of the Aeronautical Chamber of Commerce and elected J. Don Alexander as president and Jack Harding as secretary. They passed a resolution approving the National Airway Marking Conference and pledged their support and co-operation.

In offering the prize money the Wichita Chamber of Commerce said that "the object of the National Airways Marking Convention is for the purpose of selecting and putting into effect a uniform national system of markings and signals that will guide the air traveling public with safety by eliminating confusion.

Suggested standard marker for regular and established airways, number indicating the route.

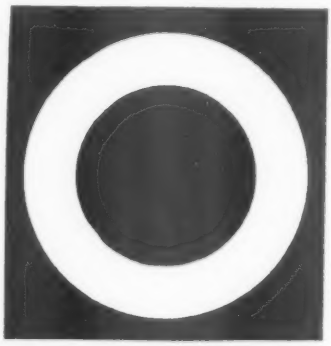
"A close study of this problem shows each community using a system of its own. The system adopted should be simple, economical to install and maintain, and should cover all weather and flying conditions. In order to stimulate interest, $1,000 in cash prizes, divided into four prizes of $500, $250, $150 and $100, will be awarded according to the best signals or markers submitted and adopted."

Everyone interested in the development of aeronautics is urged to attend the conference and to submit suggestions or designs to the Aeronautical Division of the Wichita Chamber of Commerce, Wichita, Kansas. Plans, suggestions and designs mailed in must bear a cancellation date not later than May 6th in order to qualify for prizes.

Some of the designs suggested are: (1) A Uniform Marker or signal to indicate North; (2) Uniform Marker or signal to direct to landing field; (3) Landing Field Marker; (4) Uniform Marker or signal indicating town or identifying location; (5) Uniform Route Markers.

Suggested marker for indicating North. Some of the markers suggested employ colors such as bright yellow.

Visitors at the conference will be guests of the seven airplane factories of Wichita, the Chamber of Commerce, and the Wichita Chapter of the National Aeronautical Association. The convention will have discussions on air transportation, marking problems, types of markers and methods of putting a uniform marking system into effect.



Standard marking, as suggested by one contestant, for indicating an airport.

Once a uniform marking system is adopted, adherence to it will not be difficult to secure, as the Aeronautical Chamber of Commerce can secure through the National Association the co-operation of nearly all the civic bodies in the country.

Suggested marker for indicating city and town names.

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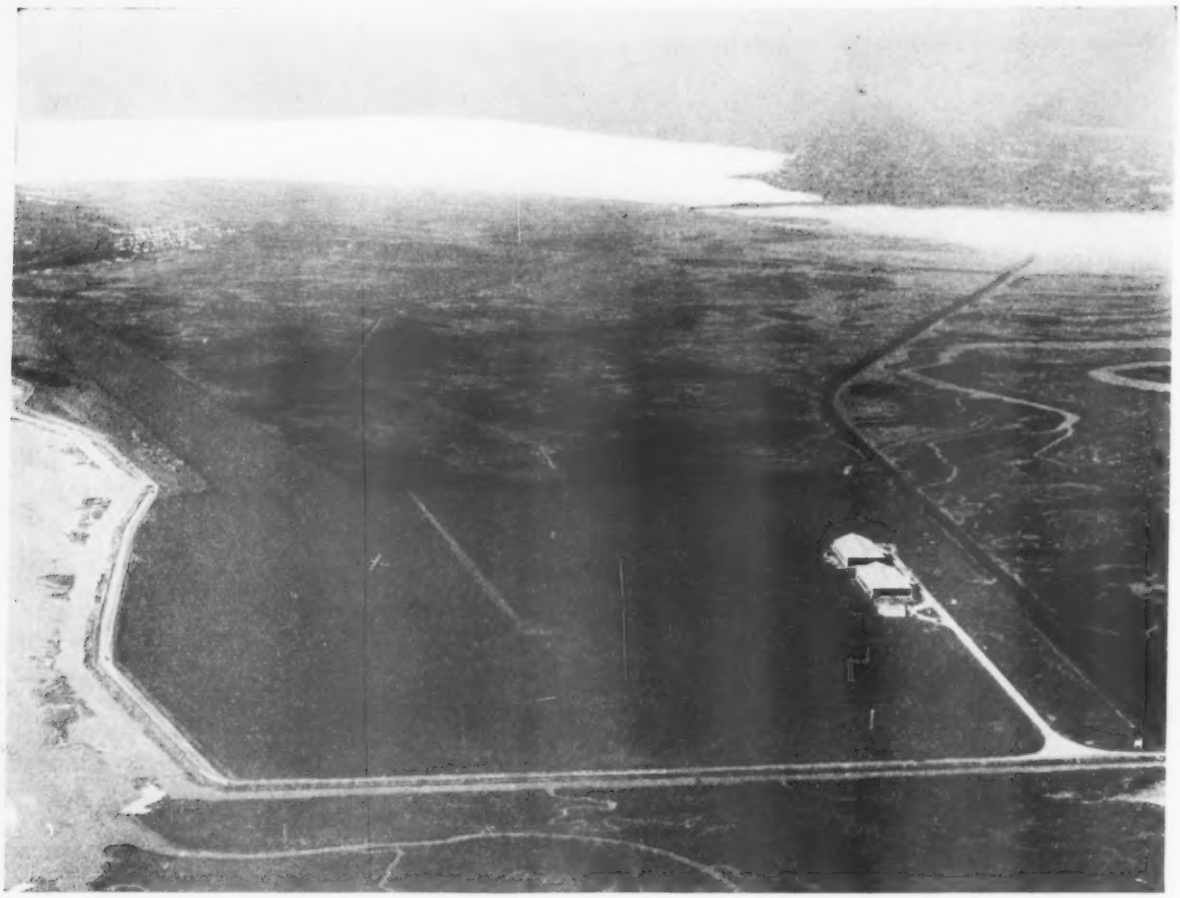

Oakland—An Air Terminal

By Earle Soto

THERE is still a wealth of romance in the golden west. Romance not actuated by the same incentive that sent the forty-niner over a rugged continent and hallowed the prairie trails with his blood and the bleached bones of his predecessors, but the romance of a universal field—the air.

California has a heritage in climate and geographical contour that ultimately will make it one of the flying centers. Every day is a flying day. Flying schools, commercial enterprises and mail lines are springing up in every nook and corner of the state. There are at present eighty-four landing fields booked and mapped and it is safe to predict that the number will be doubled during the year. This figure does not inclue the many privately owned fields.

And when one speaks of aviation in a section or locality, one naturally looks for a "hub" or center of the industry. Today the Oakland municipal airport looms as the potential "balancing pole" of aviation on the Pacific coast. Intersectional pride will probably dispute this point, but a glance at the map and a talk with internationally known pilots who have flown the field will more than affirm the prediction.

It is situated approximately in the center of the state on the border of one of the greatest harbors in the world—San Francisco Bay. Coastwise and foreign shipping trade as well as transcontinental railroads center at this point. It is the logical terminal for future trans-Pacific airlines.

When the airport was visited in 1927 by F. Trubee Davison, Assistant Secretary of War for Aeronautics; Porter Adams, president of the National Aeronautics Association; Major-General Mason M. Patrick, chief of the Air Corps; Colonel Charles Lindbergh and other high officials, they all proclaimed it one of the best fields in the United States. It is one of the largest.

Anthony H. G. Fokker, designer and aviation authority, said, "Your airport is the best in America. It is also the best in the world with the exception of the one in Berlin, Germany, which excels it, due to its central location. But your port will surpass the one in Berlin when it is completed."

The airport has a total area of 825 acres and is practically level. It has a main runway of 7,020 feet which

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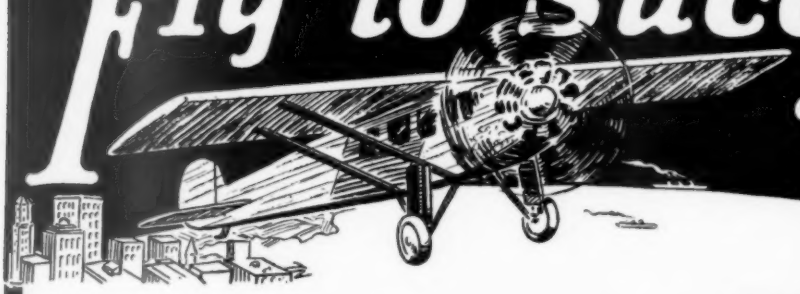

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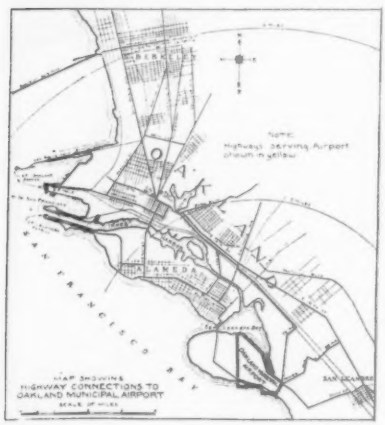
heads into the path of the prevailing winds. The dimensions of the port north and south are 8,336 feet and 7,200 feet east and west. The soil is alluvial, with some sand and gravel where fills have been made, thus giving a firm and springy landing surface. To facilitate proper drainage, a system of tile laterals, laid in stone filled trenches and spaced sixty feet



apart, discharge into two large mains.

The property was acquired by the city of Oakland last July at a cost of $766,887. Improvements to date have brought the investment figures or money expended by the city to well over the million dollar mark. At present there is an improved field approximately 2,500 feet square. Under the jurisdiction of the Board of Port Commissioners of the Port of Oakland, presided over by Roscoe D. Jones, plans and construction are now under way to level, drain and turf the entire 825 acres. A summer recreation park is also planned.

Although two hangars have been rushed to completion, enough applications have been filed with G. B. Hegardt, chief engineer and port manager, to utilize the space in half a dozen hangars. The port is six miles from the business center of the city and is free from obstructions on all sides. It is bounded on two sides by water, thus insuring hydroplane service. It is also free from most of the fogs which frequently hang over the lower part of San Francisco Bay. The field is equipped with the "last word" in floodlights and markers, while lighted airlanes from all parts of the state are rapidly centering at the port.

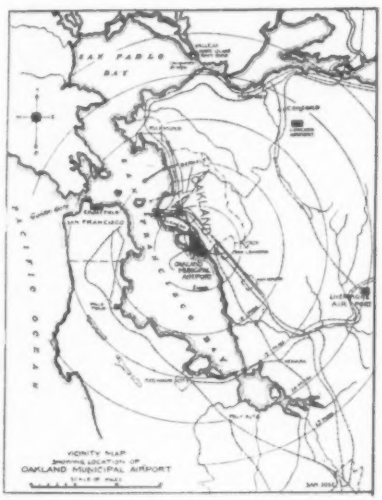
Oakland airport was first brought before the eyes of the public under rather unfortunate circumstances; however, if the Dole flight accomplished nothing else it has caused the westerner to talk aviation. Where there is talk there is argument. Where there is argument there is activity and where there is activity there is progress.

American pioneers in airline promotion are fighting a stubborn but winning battle against the "let Lindy do it" sentiment. One of the greatest struggles has been to extract the military from aviation—to transform it, in the minds of the public, from a death-dealing weapon of destruction into a normal power of construction. The government and the states have aided greatly by promoting safety through rigid rules and regulations and by extracting the thorn of the "flying crate" from the side of the public.

The rate of development is regulated by the interest of every individual. It is the duty of every American to become interested in airline companies and to make them successful by patronage. Business men should not regard them as promotion schemes, but should become a part of the personnel and exercise the same dexterity in directing the organization as that which insured their own private success. An airline organization not only serves the public but acts as an aid to the government to keep abreast of the other comprehensive powers.

The average person wants to fly in spite of a certain timidity. He is somewhat appalled at the idea, but after a second or third ride in one of the modern passenger planes he becomes innoculated with enthusiasm. Generally on the first ride he tries to hold the ship in the air by main strength and awkwardness and employs conservative methods with his breath. When someone reminds him of the graveyard pallor that has gripped his countenance he suddenly realizes that perhaps the pilot has a dear mother or grandmother or wife or family or a dinner engagement somewhere and is just as anxious to arrive at his destination safely as the passengers in the cabin. From then on he relaxes, rides with the ship, enjoys the scenery and gives the pilot the air.

It is no secret that the real westerner likes to come to town, peddle his wares, confer with his banker, buy his groceries and then stand around the corner and settle the weighty questions of the day. Not so long ago at one of the main intersections of the city of Oakland a farmer, bearing all the earmarks of success, was heard to remark to a friend, "You know, Al, I think that anyone who would go up in one of those confounded contraptions ought to have his head examined." Several seconds later a troop of bellowing newsboys rounded the corner, heralding a blazing headline about the results of a certain flight and dispersed into the crowd. Brushing the foxtails from his coat collar, the farmer elbowed his way through the crowd, trod roughly over dainty feet with his cumbersone brogans, extracted a daily from the jostled newsie and triumphantly centerrushed his way to the curb. In haste he scanned the prized sheet and proudly slapping his friend's back



with a plow-moulded hand, exclaimed, "By Gawd, Al, he made it!"

It has been said that the average man cannot talk a proposition very long without trying it.

Nor is it to youth, alone, that aviation is being sold. When Henry Ford at sixty-three years of age took a ride in an airplane and said that there was "nothing to it" and that he felt as safe as "when on the ground," he sold more aviation morale to persons ranging from seventeen to sev-

(*Continued on page* 91)

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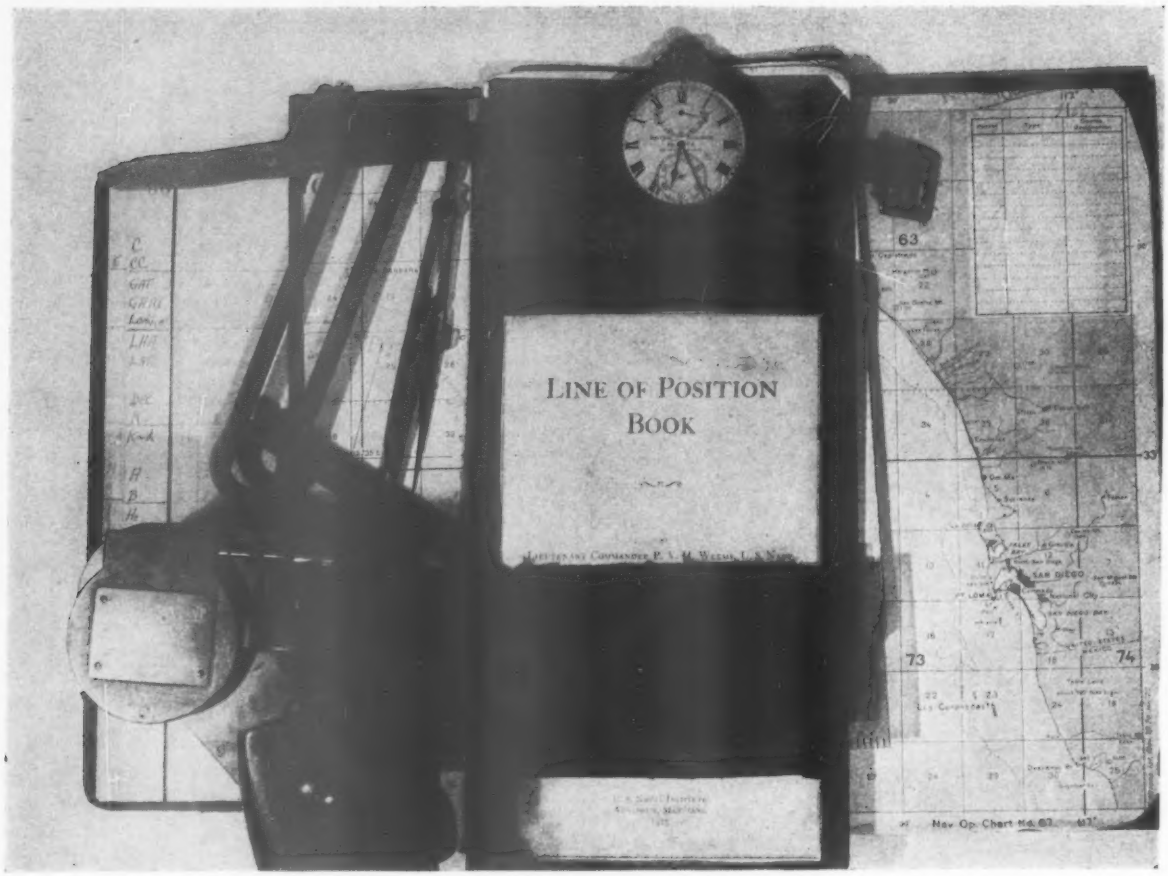

Avigation

By Lt. Cdr. P. V. H. Weems, U. S. N.

LIEUTENANT BYRON J. CONNELL, holder of several air performance records, states that avigation is five years behind aviation. This may be partially explained by the fact that while thousands of our best engineers are devoting their time to the various engineering phases of aviation, the number thinking of avigation are relatively few, while the number of really expert avigators may be counted on our fingers. The natural field for recruiting avigators is from the list of sea-going navigators, for here we find a group already familiar with plotting, the magnetic compass, computing the altitude and the azimuth, weather conditions, and with many other phases of avigation. However, if an expert navigator of a sea-going vessel would essay avigation, he must first go through a course of training with the bubble sextant, and he must also be able to work and to think quickly under the difficult conditions incident to flying. Furthermore, while the course-wind-speed problem in avigation is similar in principle to the set and drift problem in navigation, the conditions under which the work is done are so much better on the stable and roomy ship, that holding a navigator's ticket does not necessarily carry with it the qualifications of an avigator.

Author's Note: If the Latin word, "navis," means ship, and "navigation" is the term for the science of conducting a ship from place to place; while the Latin word, "avis," means bird, why not "avigation" for the science of conducting aircraft (the human bird) from one position to another?

An avigator must not only be handy with instruments, but he must also know exactly what he is doing at all times and there is no time to peruse sailing directions and reference books. There is no royal road to this knowledge either,—it comes only with application and practice. This is in no sense meant to discourage the beginner; as a matter of fact, there is nothing in avigation really difficult, or calling for greater intelligence than that of the average high school boy, and what avigation most needs just now is the boost which the

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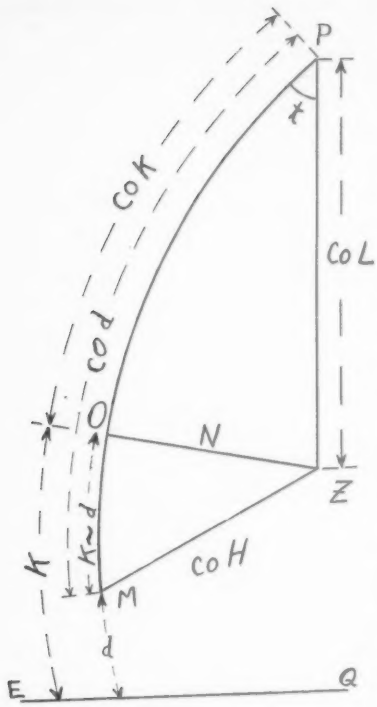

Figure 1

enthusiasm of amateurs can best give. The only warning to beginners is that they should treat this subject as they do engineering and other problems, in a systematic, thorough manner.

Another reason for the neglected status of avigation is the fact that in the past there has been only slight and spasmodic need for the new science. The radius of flight of most aircraft was small, and few long-distance flights were undertaken. Some of the flights which required expert avigation were the flight of the German Zeppelin from Europe to Africa and return during the war, the NC-4 flight in 1919, Sir Alan Cobham's London to Melbourne flight, and to come down to the recent past, Byrd's polar flight, Pinedo's four continent flight, Lindbergh's epochal New York to Paris flight which was quickly followed by Chamberlain and Levine, and finally the performance in the Pacific by Maitland and Hegenberger, Smith, and the Dole flight contestants. These flights of the past, while wonderful enough, have not succeeded in establishing an efficient system of avigation. As a matter of fact, on some of these flights, only dead reckoning was used, while on others, special aid in the nature of station ships were used, as well as radio beacons. The system of avigation we shall use in the future has not yet been standardized.

Looking into the future, we visualize trans-ocean air liners running with the regularity of ocean liners, and when these air lines are established, we shall require the most efficient system of avigation we can evolve. At present we have neither the instruments nor the methods for dependable efficient avigation.

Having discussed avigation in a general way, we shall now take up the more definite problems involved. Avigation, or the science of determining one's position in the air, may be divided into, (1) Geo-avigation, which indicates that the position is determined by means of objects on the earth, and, (2) Celo-avigation, which indicates that the position is determined by observation of heavenly bodies, viz., sun, moon, stars, and planets. Geo-avigation may be further divided into (1) piloting, where the position of the craft is determined by direct observations of objects on the earth's surface and radio bearings, and (2) dead reckoning, where the position is calculated from the estimated course and distance from a known position, called the point of departure.

In practice, an experienced aviator would not actually observe with instruments the bearings and distances of objects in sight, as his judgment of position would suffice for ordinary needs. Dead reckoning calls into use the compass, the drift indicator, the altimeter, the air speed meter, and the radio. Both piloting and dead reckoning are facilitated by a knowledge of aerology; in fact, safe flying is impossible without a reasonable understanding of aerology, since an uncertainty of the force and direction of the wind is the cause of the greatest errors in avigation.

While geo-avigation is today more important than celo-avigation, yet it is already apparent that the time is coming when celo-avigation will increase in importance. Still further in the future, radio position finding will undoubtedly replace, to a large extent, all other methods; at the same time, during war, and in case of radio failure, a knowledge of celo-avigation will be indispensable.

It is necessary to orient ourselves with these elementary definitions before taking up the detailed discussion of methods and instruments. In order to cover in detail one phase of avigation, we select the subject of celo-avigation, which the average layman, in a vague way considers when avigation is mentioned. Briefly, celo-avigation consists of finding

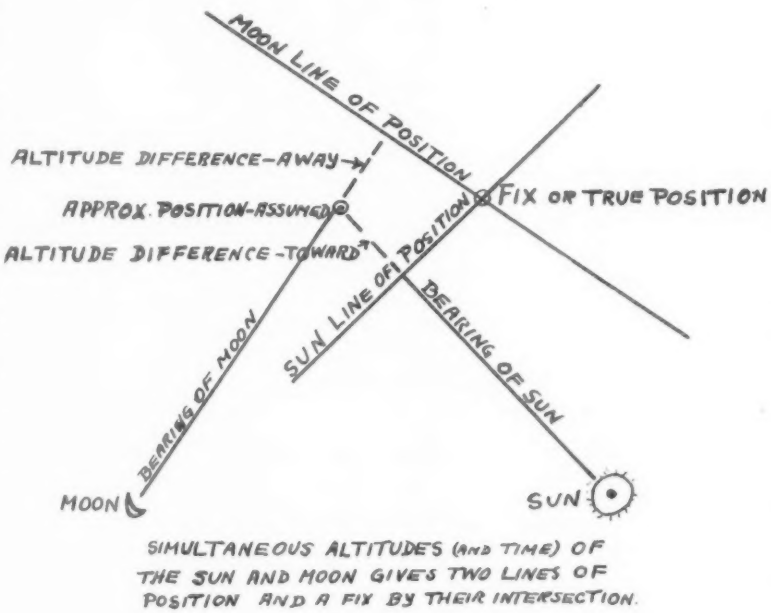
MOON LINE OF POSITION
ALTITUDE DIFFERENCE-AWAY
APPROX. POSITION-ASSUMED
ALTITUDE DIFFERENCE-TOWARD
FIX OR TRUE POSITION
SUN LINE OF POSITION
BEARING OF MOON
BEARING OF SUN
MOON
SUN
SIMULTANEOUS ALTITUDES (AND TIME) OF THE SUN AND MOON GIVES TWO LINES OF POSITION AND A FIX BY THEIR INTERSECTION.

Figure 2

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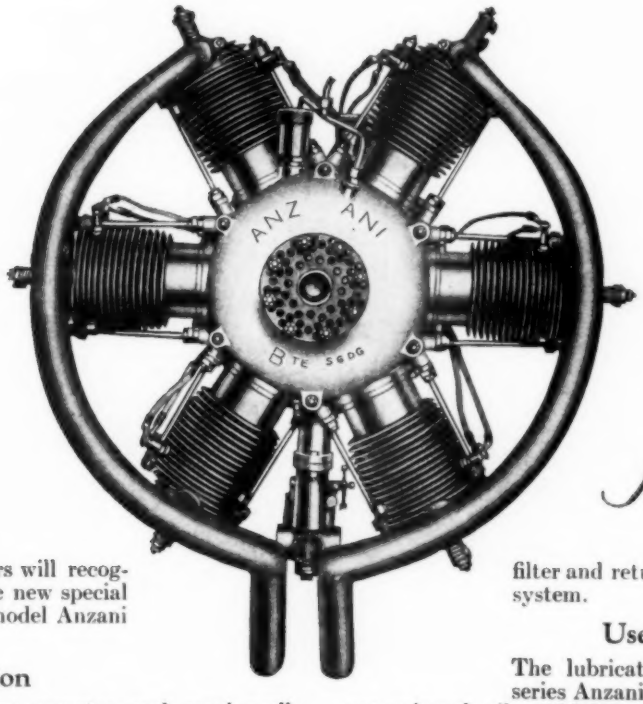

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Two separate high tension magnetos, each serving all cylinders—two spark plugs per cylinder. Magnetos are the highest type of modern design and located in a well-protected but easily accessible position at the rear of the crankcase.

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These and many other improved features of the new Anzani assure the utmost in economy and dependability of operation for all requirements of from 18 to 120 H. P. We will be glad to furnish complete specifications. Let us know your requirements.

The following stock 1928 models of the Anzani Engine give a power plant range to meet the requirements of light commercial airplanes:

Rated H. P.	*Normal r. p. m.*	*Weight (lbs.)*	*No. of cylinders*	*Bore (inches)*	*Stroke (inches)*	*List Price*
35	1700	115	3	4.133	4.724	$735
60	1700	165	6	3.543	4.724	1325
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120	1550	320	10	4.133	5.512	2170

The prices quoted are for Engine complete, including magnetos, carburetor and exhaust collector ring.

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and plotting one or more lines of position, the observer's position being at some point on each line of position. Two lines of position give us a fix, i.e., definitely locates our position, since the intersection of the two lines is the only point common to both lines, and by definition, both lines must pass through our position.

The principle of the line of position is simple and may be illustrated as follows: if we stand 100 feet from a 100 foot telephone pole and measure the vertical angle of its height, we get 45 degrees. This angle limits our position to a circle of 100 ft. radius from the pole, but does not fix our position, as we may be any place on the circle of equal altitudes. If the angle measures less than 45 degrees, we are more than 100 ft. from the pole, and if more than 45 degrees, we are less than 100 ft. from the pole. If we now get the angle on another pole of known height, we determine another circle which passes through our position. Since we are on both circles, we are at an intersection of the two circles. There are two possible intersections, making possible either one of two positions, but by knowing our approximate position, we may eliminate one intersection.

Now applying to a heavenly body the same principle as was applied to the pole, we compute for an assumed position, the altitude. For a given altitude of a heavenly body, we may be at any point on a circle of equal altitudes as in the case of the telephone pole. If we assumed the correct latitude and longitude for computing the altitude, the true, or measured altitude should be the same as the computed altitude; but as is usually the case, these values of the computed and true altitudes may differ, and the difference is the amount by which the assumed position is in error, therefore, if we move the line of position in the proper direction by the amount of the altitude difference, we arrive at the correct line of position. Also, since the circles of equal altitudes are so large, a small portion of it may be considered to be a straight line, hence, we say, "line of position," instead of, "circle of position."

The line of position being at right angles to the bearing of the body as in the case of the telephone pole, we move it toward or away from the body by the amount of the altitude differences. Also, since a smaller angle means that we are farther away from the body, a measured altitude less than the computed altitude necessitates moving the line of position parallel to itself and away from the body, while if the true altitude were greater, the line would be moved toward the body. If we take a similar observation of another body, we obtain another line of position, and the intersection of the two lines gives us a fix, that is, our correct latitude and longitude.

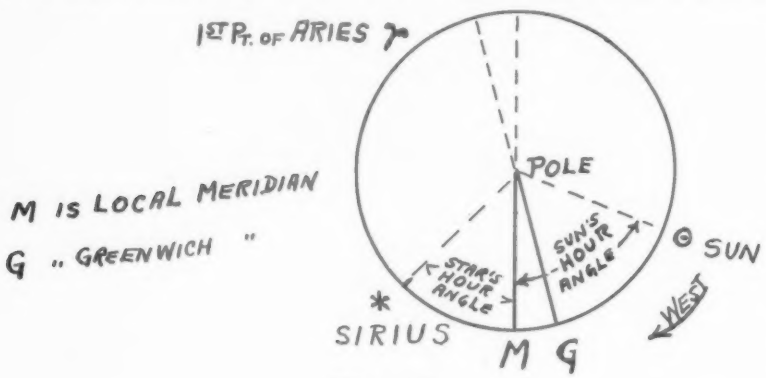

Figure 3

The observation and the computation of the altitude is the major operations in avigation. This computation is accomplished by any of several different methods of solving the spherical triangle. We have given the approximate latitude, (l) we take the declination, (d) from the Nautical Almanac, and we compute the hour angle (t) from the time of observation. Thus we have two sides and the included angle to find the third side, the altitude (90-h), and a second angle, the azimuth (Z). Figure 1 shows the spherical triangle to be solved for the altitude (h) and the azimuth (PZM). If we plot two lines from two heavenly bodies we get a situation as shown in Figure 2. We assumed our position to be at A, but find that we move away from that point to get the correct lines of position, and these lines intersect at B, our true position, or fix. The determination of the hour angle, t, is one of the most difficult operations for the beginner. A time diagram similar to Figure 3 helps to visualize what the hour angle is.

It is hoped that this necessarily sketchy outline will stimulate the interest and thought of beginners interested in avigation. While no one can know too much of either navigation or avigation, the work is most fascinating, and it is a real pleasure to build up step by step our computations and then find that the results reward us with useful knowledge as to our position.

Black Starts New Trip

Van Lear Black, publisher of the Baltimore Sun, who made a 20,000 mile trip last year, which was one of the outstanding air events of 1927, has arranged for an even longer trip for this summer.

Albert Plessman, director of the Royal Dutch Airlines (K. L. M.), has announced that Mr. Black has chartered a Fokker plane for a flight from Amsterdam to Cape Town, from Cape Town to Cairo, from Cairo to Batavia, and from Batavia to Hongkong. The flight from Amsterdam to Cape Town and from Cape Town to Cairo will equal last year's flight in mileage.

Mr. Black is a pioneer in air travel and holds the record as a passenger in the air. One of Mr. Black's pilots of last year, Geysendoffer, will be a pilot for him this year, and will be relieved by pilot Scholte. Both are regular pilots for K. L. M.

Last year Mr. Black chartered one of the Fokker ships of the Royal Dutch Airlines, which was taken off its regular run and refitted for the long trip. Passenger seats were removed and a table, desk and chairs substituted and room was made for reserve fuel tanks.

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It is only logical that keen business men, of means and commercial ability, who have during the recent past, and are at the present time entering the business as dealers and distributors, should prefer a plane with the span of years of successful building back of it, that Swallow alone can offer.

See the new Swallows at the All-American Aircraft Show at Detroit—but if you are planning to become a dealer, don't wait until then to find out whether your territory is open. DO IT NOW—a wire is quickest and safest, and will bring full details of the bigger money-making Swallow dealer's franchise.

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All-American Aircraft Show

THE All-American Aircraft Show in Detroit marks the first invasion of the new industry into the stamping ground of our old pet—the automobile. There are many who feel that Detroit may become as noted for the production of aircraft as it is now for the mass production of automobiles. With many of the basic needs taken care of through the established automotive industries Detroit should have little difficulty in establishing herself in this place.

The present demand for air transportation, for air travel as a means of fast communication, for flying as a sport, opens up the field in a manner that gives rise to many conjectures. The public will have, for the first time since the recent epoch-making flights, an opportunity to see just what is the present status of this transportation industry.

It may safely be stated that Mr. Man-in-the-Street will be astonished at the number of different makes of craft shown, many of which are pictured on the following pages. Aircraft have well defined uses today and the various manufacturers are rapidly standardizing their craft in relation to the use expected of the airplane.

The show is twofold in its purpose. It will not only acquaint the possible future prospect with the various makes and types of planes available for his use at the present time, be it for sport, business, trucking, taxying, or any of the many purposes for which aircraft are used, but it will also serve the purposes of the manufacturers and dealers.

The distribution of aircraft is not yet fixed. There is good reason to believe that it will in a large measure follow the same lines as that of dealer representation in the automobile business. At the present there is an essential difference. It is quite a different matter to teach people to fly compared with teaching them to drive an automobile. Sooner or later all dealers in aircraft will be compelled to offer school facilities to their customers. For the present reliance must be placed on the schools which are turning out flyers in greater numbers than planes are being manufactured for their use.

There is a difference of opinion in various parts of the country as to the type of dealers desired as representatives for aircraft manufacturers. In many cases automobile dealers have been attracted into the field and through the use of the same type of good salesmanship as is employed in their business have made conspicuous successes. Other successes just as conspicuous have been made by flyers who have gone into sales work.

Regardless of opinion on this matter the fact remains that a great opportunity stands waiting for men of ability, both in salesmanship and organization work, in the sale of aircraft to the waiting public.

Today the automobile show is an event that is awaited by many prospects. It is salesmanship combined with showmanship and focuses attention on the entire industry. It is not too much to expect that the same thing will happen with aircraft.

At the present too many people believe that the airplane is a highly specialized machine, merely for express and mail transport and for the use of a very limited number of travelers who are in a hurry. The industry needed the public attention which it received last year. It brought aircraft definitely into prominence as transportation. Now is needs something more than this popularizing. It needs salesmanship—the type of selling that will make the individual realize that there is in the airplane something he can use in his own daily life—whether that be for business or pleasure.

On succeeding pages will be found photographs of many of the planes and accessories exhibited.

A particularly appropriate event occurs just as this edition of Popular Aviation goes to press. A Detroit man, in a Detroit-built and Detroit-named plane, has just captured the world's endurance record. Edward Stinson, accompanied by George Haldeman, has for the second time won the endurance record—this time by a flight of 53 hours, 36 minutes and 30 seconds, beating the record of Risticz and Edzard by 1 hour, 13 minutes and 59 seconds. The record was made at Jacksonville Beach, Florida, in a Stinson-Detroiter monoplane.

A new remarkable record by Lieut. Alford Williams

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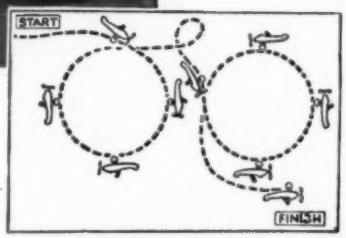

No greater strain has ever been placed on man or ship than Lieut. Williams experienced in negotiating six consecutive "outside" loops on February 27. Meyrowitz Luxor Goggles were his sole eye protection.

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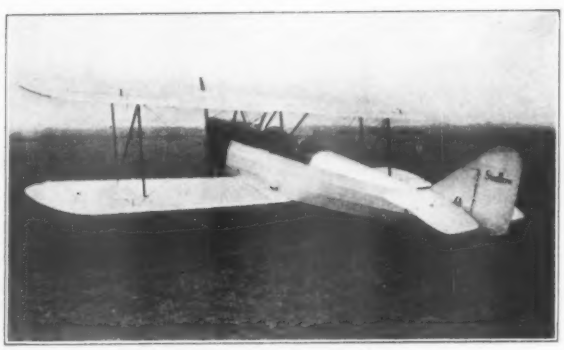

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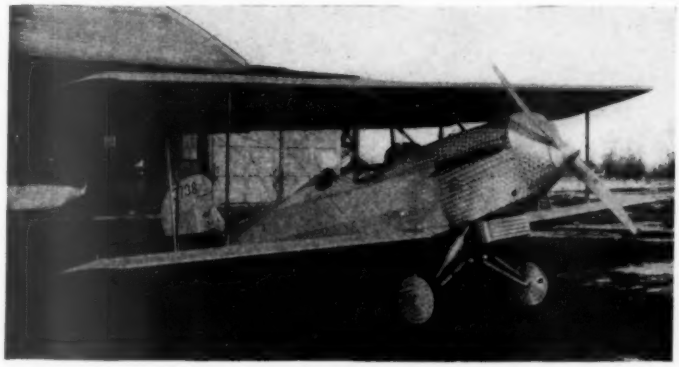

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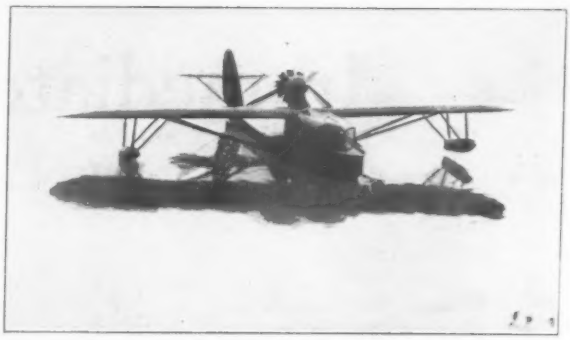

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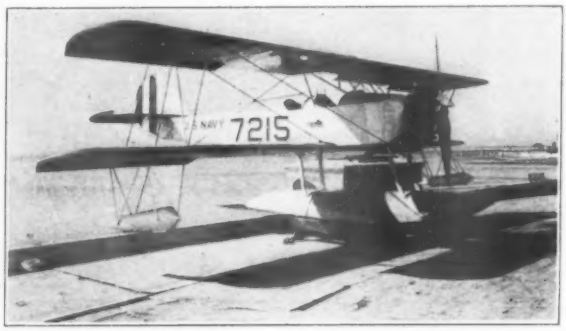

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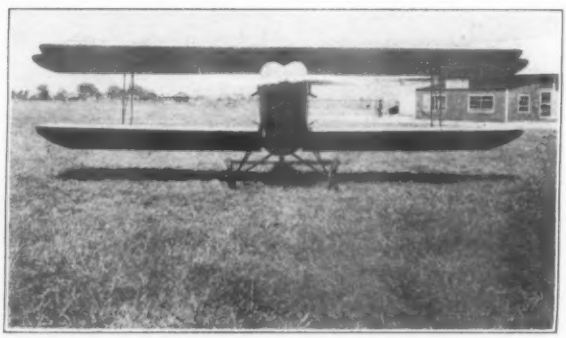

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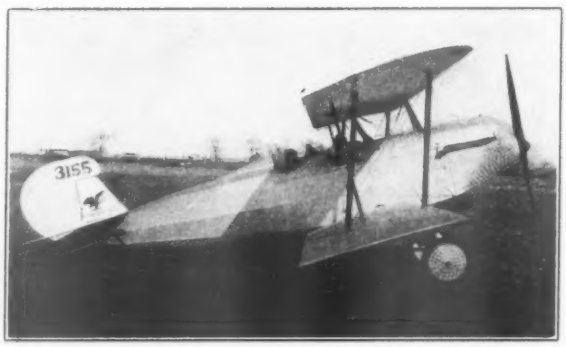

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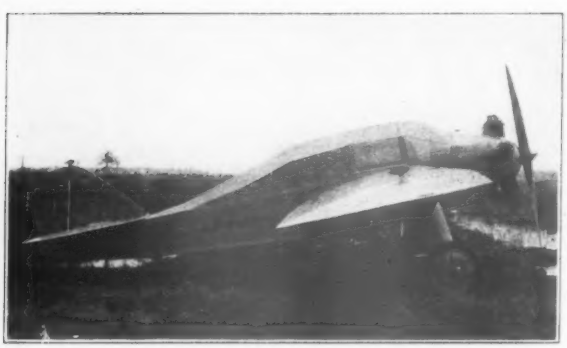

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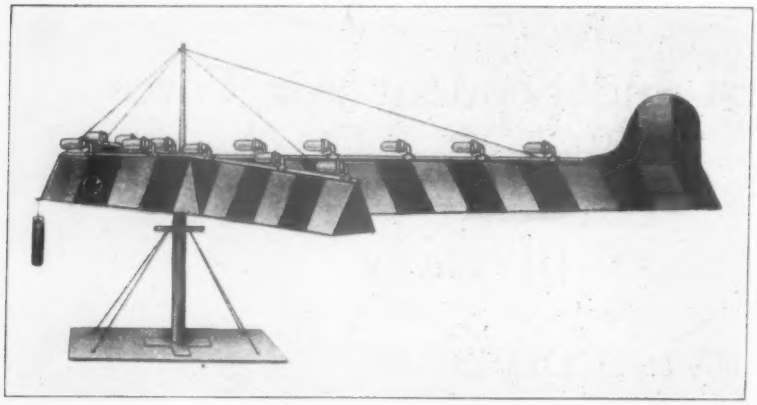
The All-American Aircraft Show

Accessories and Engines

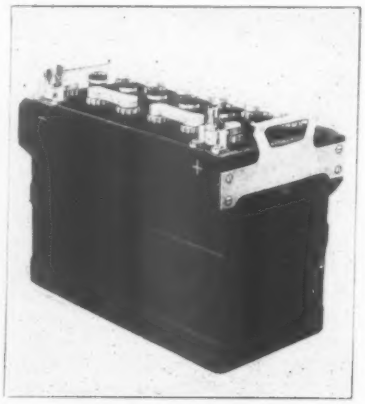
Space prevents the showing of all of various accessories displayed at the All-American Aircraft Show at Detroit. On the following pages a few of the accessories and some of the motors are shown. Motors are shown, whenever possible, in two positions, in order to convey to the reader as clear an idea of the relative position of the parts as possible. The manufacturer's rating of horsepower is also given.



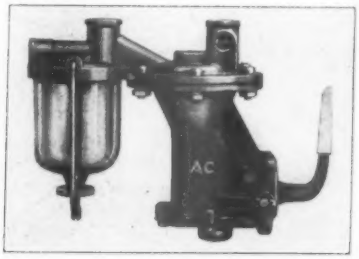
Wind Tee—Crouse-Hinds Co.

Military Type Aerial Camera
Fairchild Aerial Camara Corp.

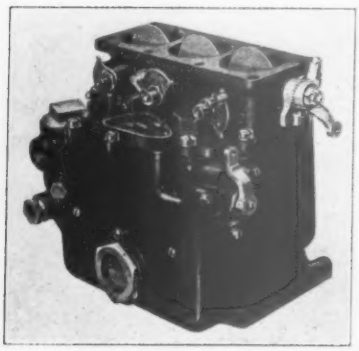
Revolving Beacon
Crouse-Hinds Co.



12-volt Storage Battery
Electric Storage Battery Co.

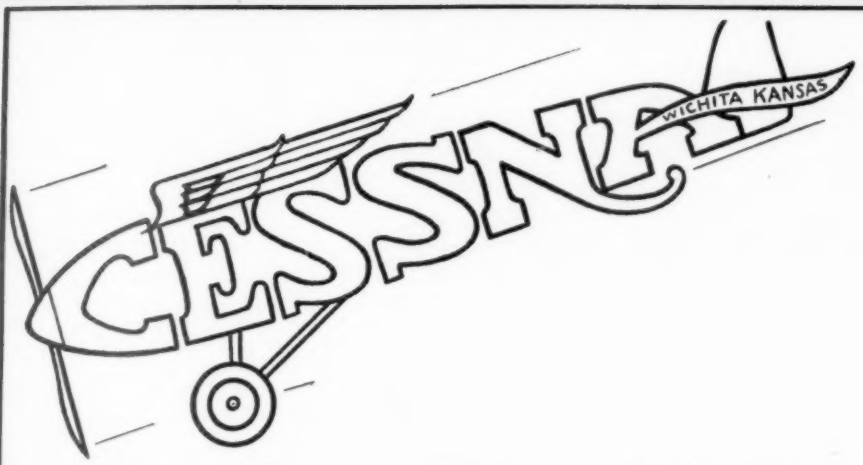


Fuel Supply System
A-C Spark Plug Co.



Carburetor
Stromberg Motor Devices

1,000 Watt Flood Light Illumination—B. B. T. Corp.



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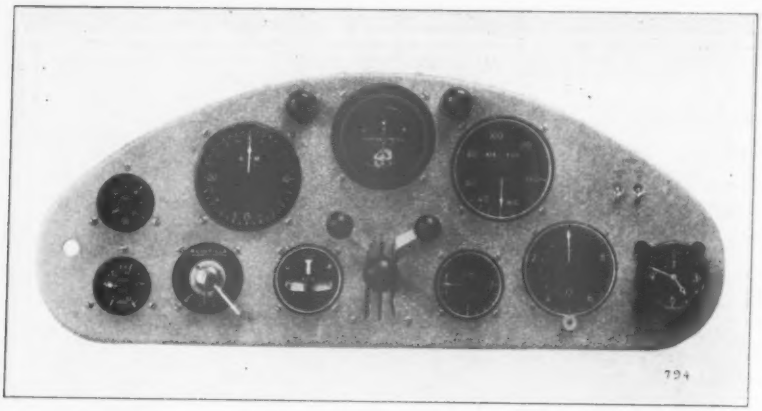
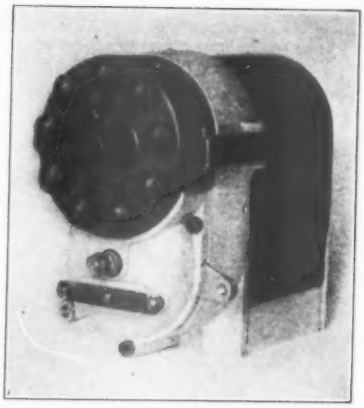


Dashboard Installation—Pioneer Instrument Co.



NS-9 Magneto
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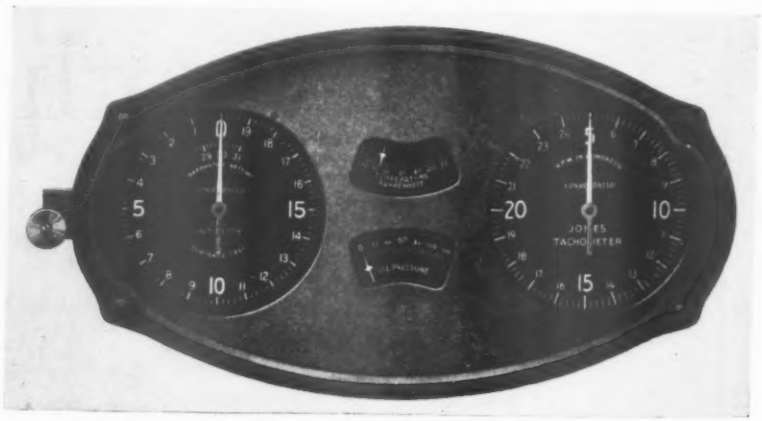
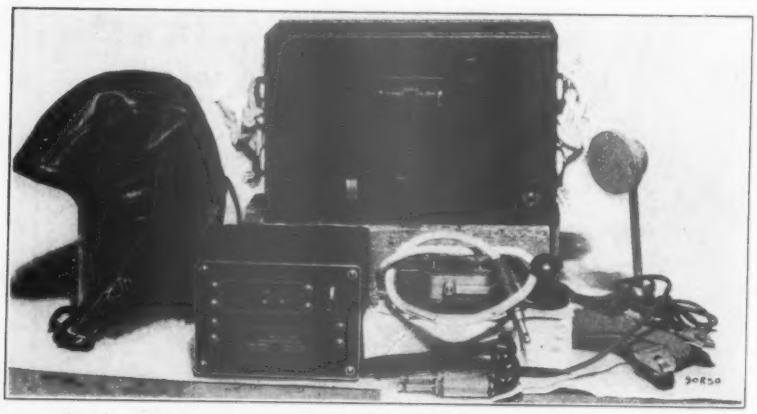
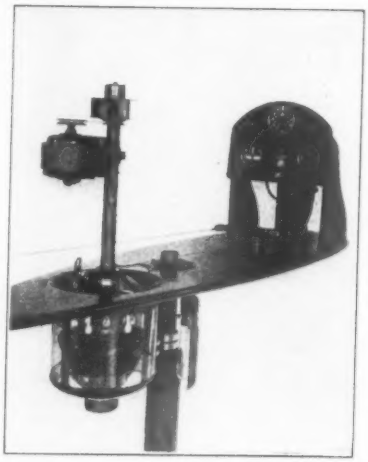
Beacon Light
B. B. T. Corporation



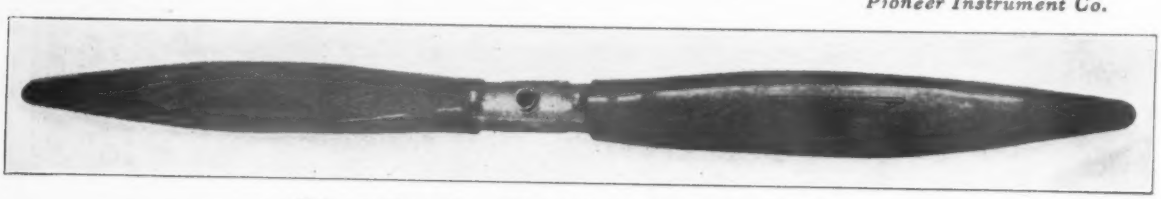
Instrument Panel—Consolidated Instrument Co.



Sending & Receiving Equipment—Radio Corporation of America



Earth Inductor Compass
Pioneer Instrument Co.



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U. S. Air Corps

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Major Victor W. Page
U. S. Air Corps

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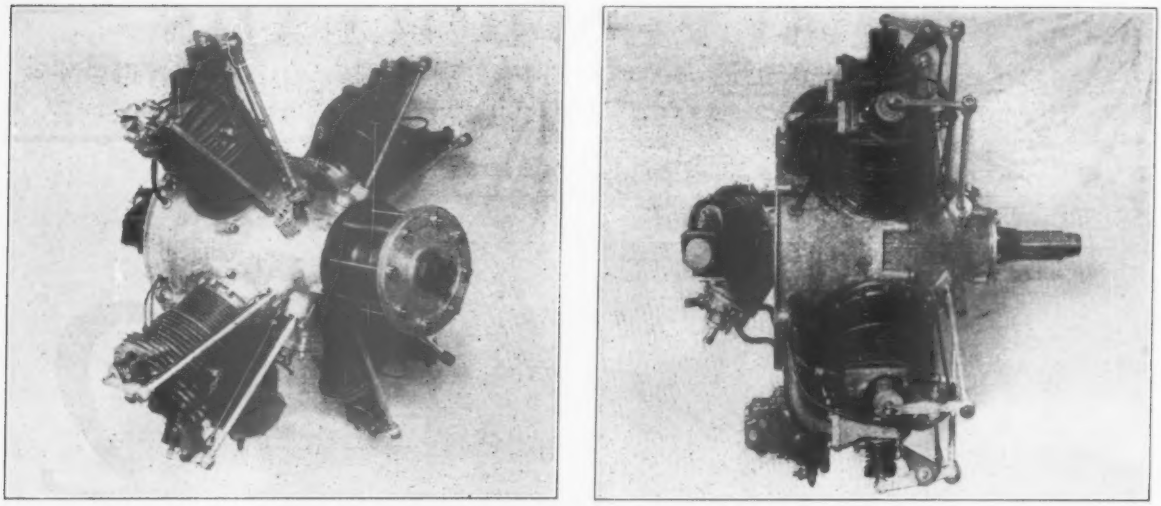
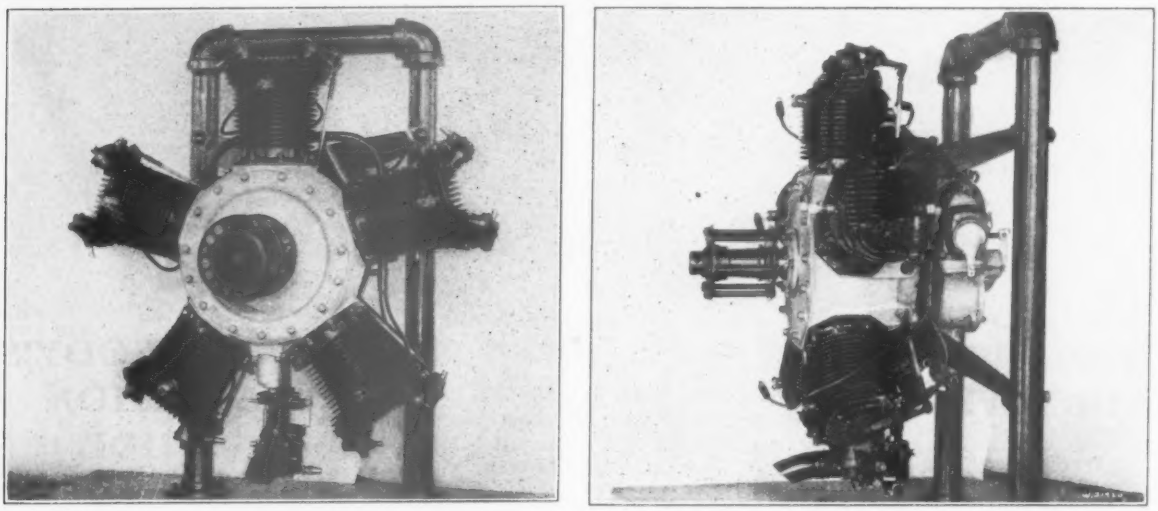
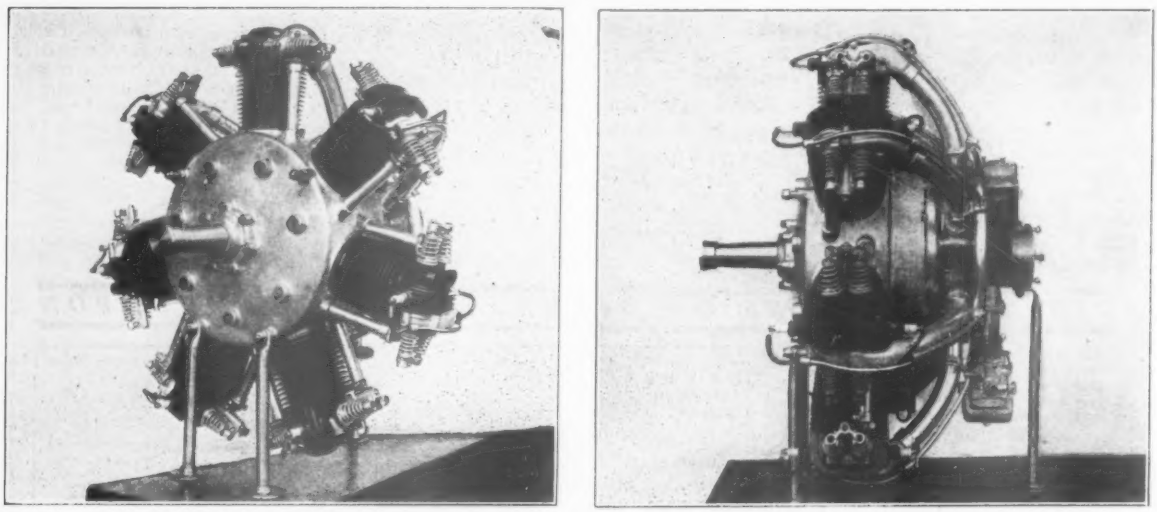


Caminez—135 H. P. Fairchild-Caminez Engine Corp.



LeBlond "Sixty"—60 H. P. R. K. LeBlond Machine Tool Co.



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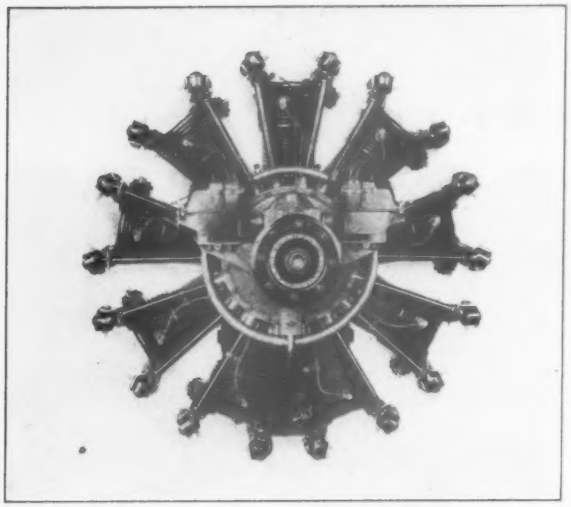
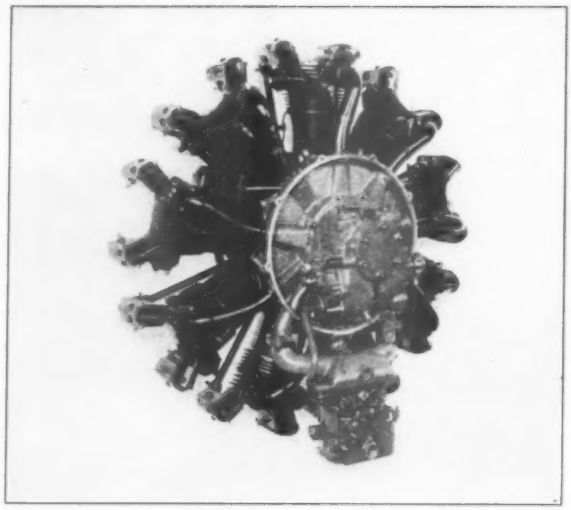
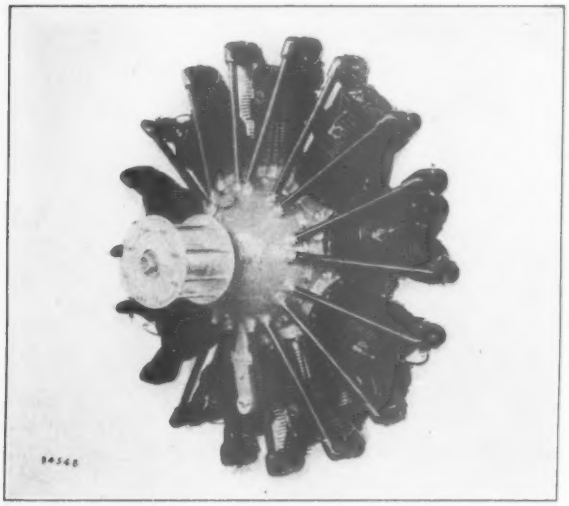
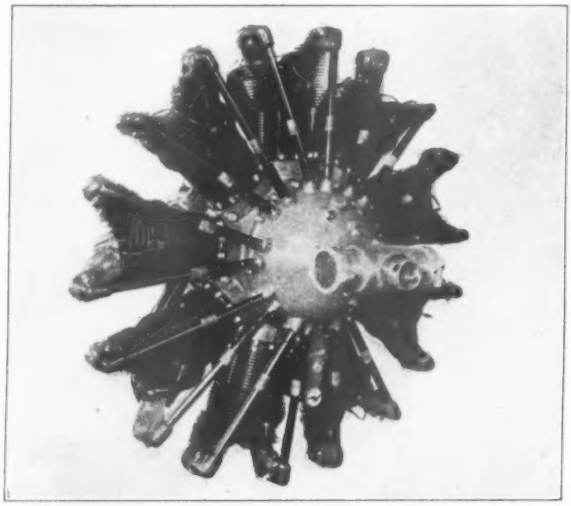




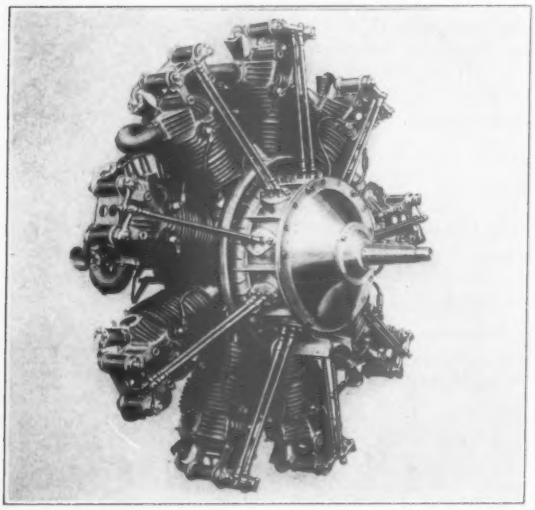
Whirlwind J-5—220 H. P. Wright Aeronautical Corp.



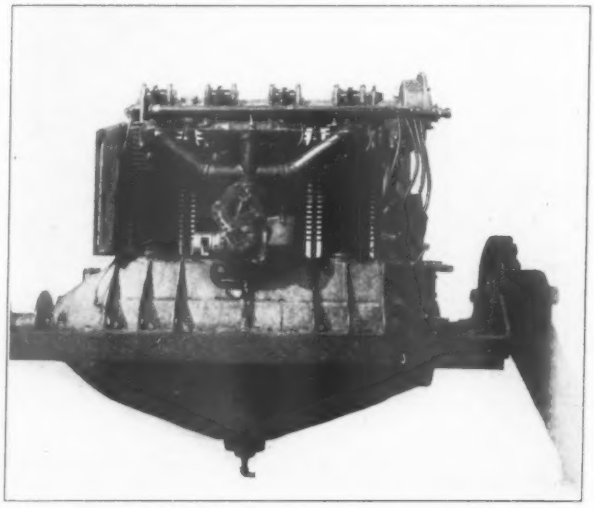
Wasp—400 H. P.—Pratt & Whitney Aircraft Co.



Hornet—500 H. P.—Pratt & Whitney Aircraft Co.



Ryan-Siemens—130 H. P.—Ryan Aeronautical Corp.



Dayton Cub—110 H. P.—Dayton Airplane Engine Co.

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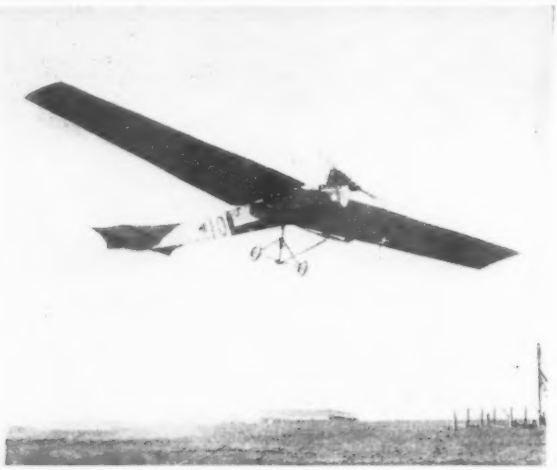
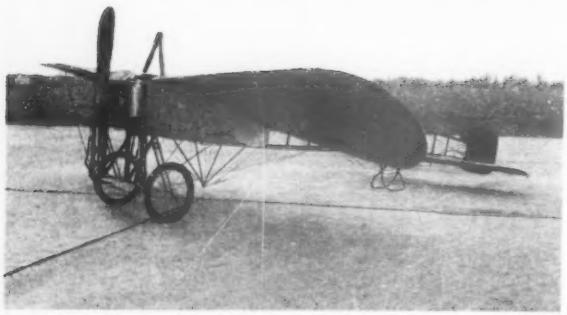
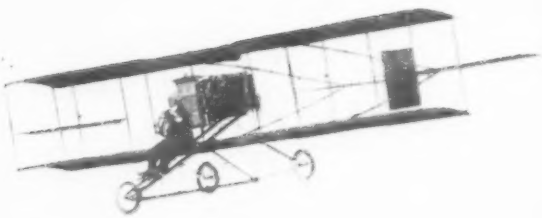
Curtiss—1907



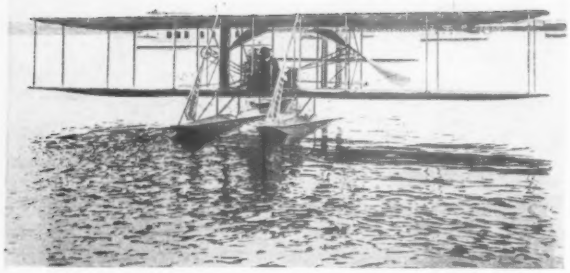
Antoinette—1909



Bleriot—1909

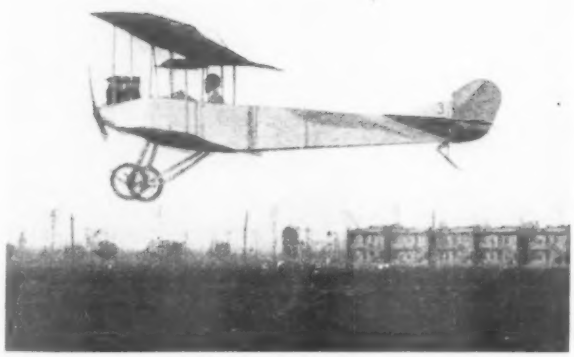


Curtiss—1911



Wright—Model B—1912

These few old planes are illustrated here to give our readers an opportunity to compare the ships of past years with the type of craft offered to the public today. About the same essential differences exist between the old type and the new as we find in the old type motor cars when compared with the automobiles of today. Engines are larger and more attention is paid to position and housing, ships and cars are both streamlined, and the passenger is allowed more comfort.



Laird—1914

WACO-TEN
RYAN-SIEMENS

What WACO Shows
—others will eventually offer

When a product leaps into prominence, through unusual performance, and continues growing in favor month after month, year after year, it surely must offer unique qualities and values.

The air-minded, are recognizing more and more how WACO engineering and production methods are *constantly leading the way*. How refinements and improvements are *first* given the public, as standard equipment on WACO planes.

Waco was *first* to offer—complete production planes at moderate prices—all steel fuselages—center sections—enclosed cowls—dual controls—side door and wing step—adjustable stabilizer—quick take off—fast climb—slow landing speed—high top speed.

Approved type certificates. Numbers 11, 13, 26

Now WACO pioneers, with the quantity production of airplanes utilizing new type motors. WACO engineers have developed the super structure of the WACO TEN to take full advantage of Whirlwind — Ryan-Siemens — Caminez and OX5 motors. This wonderful plane—the acknowledged leader in its class—now gives more performance and is more dependable than ever.

See the Waco at the All-American Aircraft Show in Detroit, April 14 to 21.

Waco offers CHOICE OF FOUR MOTORS —a wonderful range of performance—a price field to satisfy everyone. See them at the All-American Aircraft Show—Detroit, April 14th to 21st.

WACO AIRPLANES

ADVANCE AIRCRAFT COMPANY
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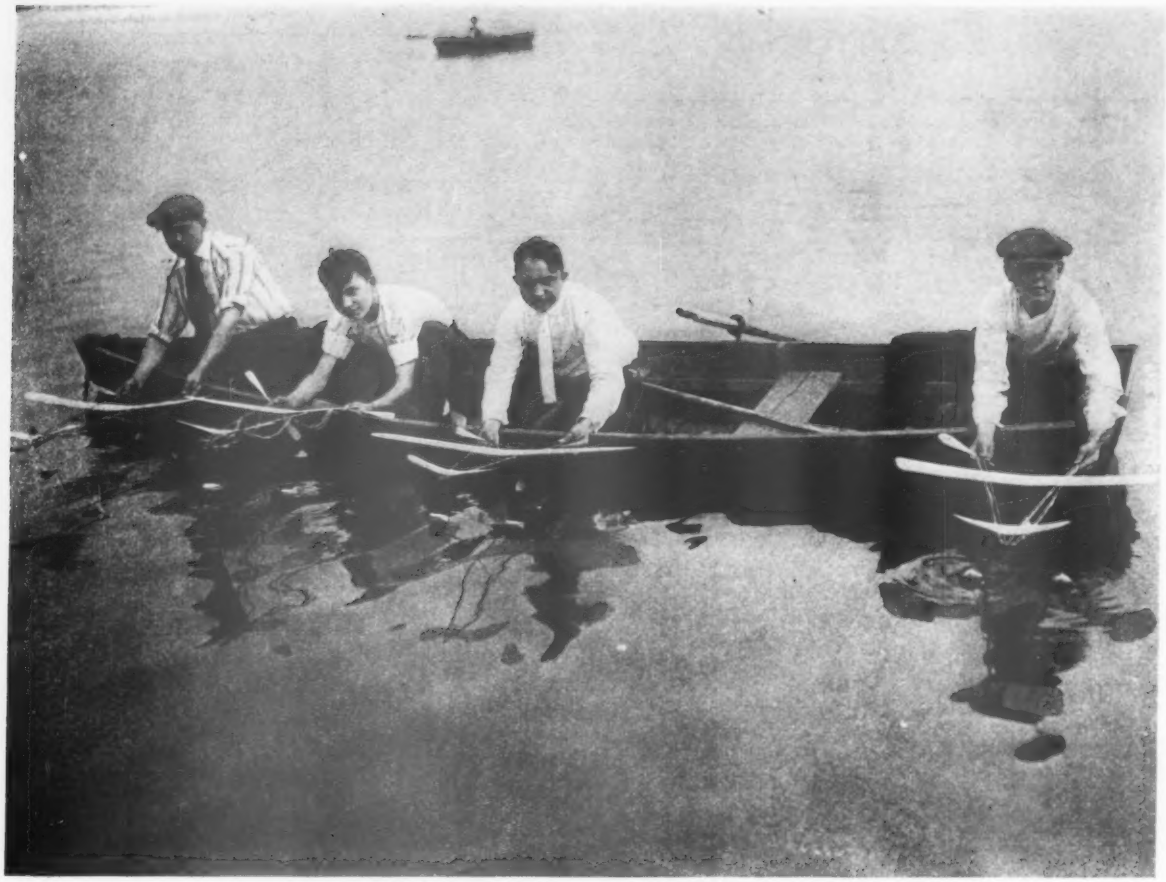

Schweitzer, Pond, Lucas and Jaros at Lake Calumet in 1920.

Elliott Special Duration Racer

JUST why did we decide that the Elliott Special Duration Racer was a model worthy of filling this space?

In the first place it is easy to build. When such a record breaking model is in the air, one wants to feel that two or three weeks work will not be wasted if the model flies out of sight and is lost. Mr. Elliott lost two of his models but made new ones each time in just a few evenings spare time.

Then, double covered wings are expensive and difficult to build. High lift wing sections are not good on a model because they shift their center of pressure too much and really need a human pilot. A model should have a rather flat wing section and Mr. Elliott made his wing very flat in section and single covered.

A sheet of model tissue, the lightest obtainable, weighs .12 to .14 of one ounce. Think how much extra weight goes into papering a wing twice. That is what you do in a double surfaced wing!

That Mr. Elliott is a keen minded model builder and student of aviation is shown by the top view of his wing. Note the contour. (See drawing.) This shape is similar to that used on many famous large planes such as Byrd's three motored Fokker; Ford-Stout planes; the Curtiss Hawk (the plane used in the outside loop experiments) and many others.

This wing form is excellent as proven by wind tunnel tests by the U. S. Government. The reason for the efficiency of this wing shape is logical. The center of a wing is more efficient than the tip. Therefore why not distribute the wing area so that there will be more area where the greater efficiency can be obtained.

Mr. Robert Jaros, who holds the official world's record for outdoor twin pusher models, used this wing form. (This record is seven minutes and fourteen seconds, and one and one-half miles from starting point when lost sight of by the official model judges at Dayton Air Races in 1924). Incidentally many of the ideas furnished to thousands of boys who have joined in the model airplane fever, caused by Lindy's trip, came directly from Mr. Jaros' fine machines, indeed some being direct copies.

Another good reason for Mr. Elliott's twin pusher is that it can

(Continued on page 70)
Scale drawing is on page 68

Here's *Your* Foundation *for Real Success*

Walter Hinton

1st —to pilot a plane across the Atlantic (the famous NC-4).

—to fly from North to South America.

—to fly to the head waters of the Amazon.

Formerly Crack Flying Instructor for the Navy

One of the first of all outstanding, nationally known, present day Aviators to rise to fame was Lieutenant Walter Hinton. But he is more than a great flier. He is a recognized writer and instructor as well. During the war, Hinton was one of the crack pilots to be picked for the Navy's important work of instruction. He knows Aviation from years and years of study; from hundreds of thousands of miles of flight; from close contact with its recognized leaders. His course has been pronounced by authorities as the finest that could possibly be produced. Few men are qualified as he is to help you get your start—and to advise and direct you in the future.

UNDERNEATH every real job Aviation has to offer—and remember the industry has fifty highly specialized branches—there must be a foundation of KNOWLEDGE. Those who have this foundation are the ones who are going to pick off the choice positions—the biggest money—the finest opportunities. How to get this necessary training—how to get it inexpensively—how to get it quickly and conveniently—those are the important questions this message will answer.

Get Your "Ground Work" Quick—at Home

Stay where you are—keep on with what you're doing—but give Walter Hinton a portion of your spare time. If you'll do that, he'll give you a practical training in Aviation that you would have to spend years and years to acquire through experience. He'll teach you all about types of planes and their uses; theory of flight; designing, construction, rigging; instruments; motors; navigation; aero dynamics and a whole lot more. His course of instruction begins where Aviation began and brings you right up to the minute. He'll show you how to cut off years in your hop to success. He'll help you get into Aviation—he'll help you get ahead in Aviation. He'll give you a solid FOUNDATION OF FACT that you can cash-in on for life.

Hinton on the Amazon

Lieutenant Hinton was the first Aviator to use a plane for purposes of exploration. Here he is shown on the Amazon river making friends with the curious natives. On this flight, he and Capt. Stevens of the U. S. Army, mapped 12,000 square miles of South America's wildest jungle country.

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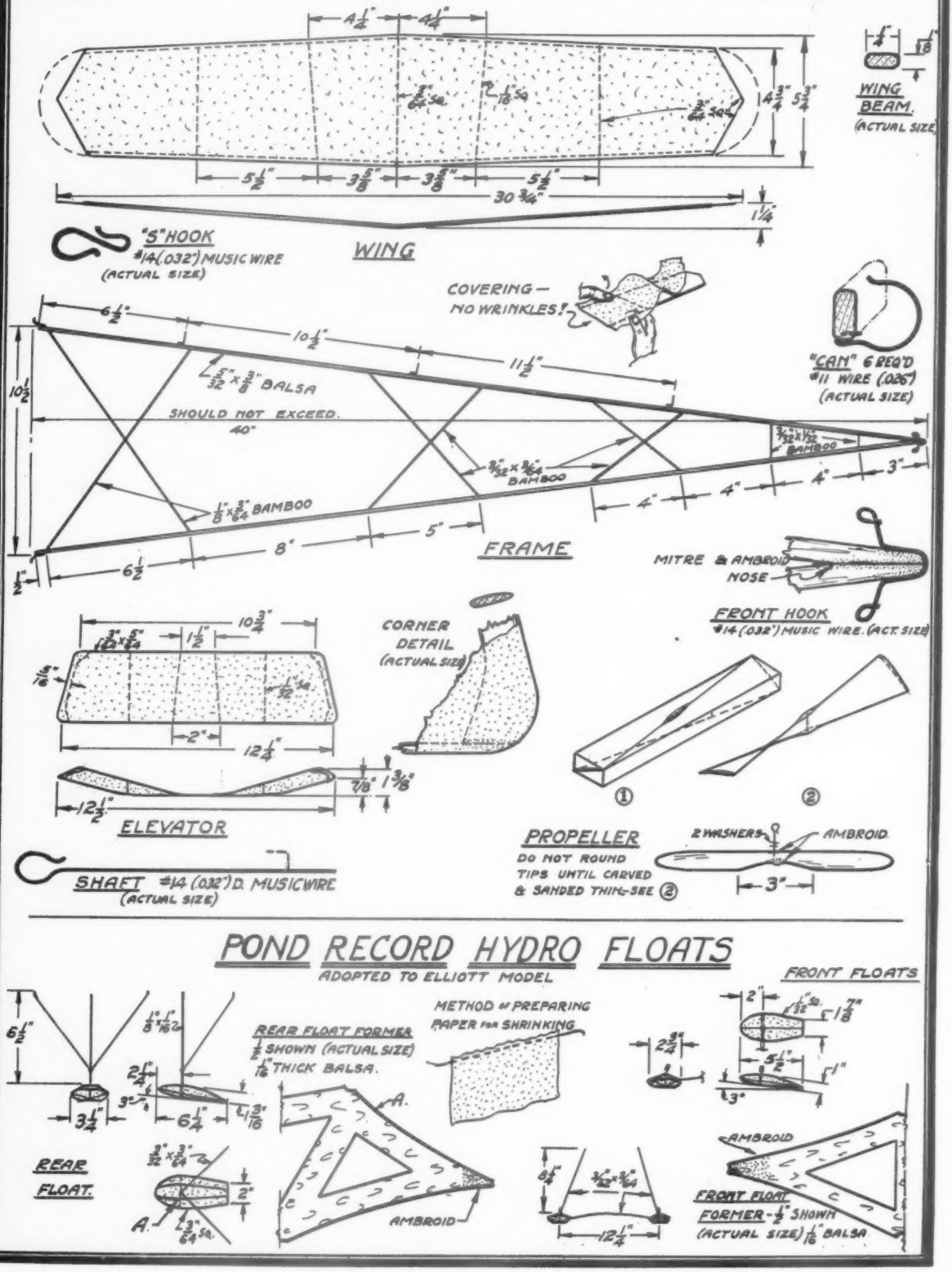
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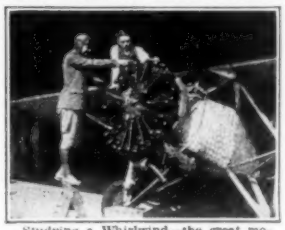

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be converted into a hydro at very little effort outside of making the pontoons. A double covered wing might survive one ducking but to expect it to last a season is too much. At the conclusion of this article are some valuable hints that will enable you to make a hydro successfully and easily.

Now that we have told you the good points of the Elliott Duration model, let us start right in and show you how to construct it easily. First of all you will need the materials listed below. Get smoothly and accurately cut balsa. These parts will be found listed at a very reasonable price in our advertising section.

1 balsa strip (for elevator) 1/16 in. x ⅞ in. x 9 in.

2 balsa motor base spars 5/32 in. x ⅜ in. x 40 in.

4 balsa wing spars ⅛ in. x ¼ in. x 14 in.

2 balsa propeller blanks ⅞ in. x 1¼ in. x 10½ in.

(Note, if your model is well made, it will fly nicely and longer with propellers cut from 1 in. x 1¼ in. x 11 in. blanks.)

1 roll No. 13 piano wire.

1 roll No. 10 piano wire (or wire parts already formed).

2 light strong steel thrust bearings, drilled.

4 anti-friction washers 5/32 in. dia. with .035 in. hole, made from good brass .010 in. thick.

1 big sheet 21 in. x 31 in. Japanese silk tissue.

2 strips casting rod bamboo, jointless 8 in. to 10½ in.

1 strip casting rod bamboo, jointless 10½ in. to 12½ in. (order one extra piece for making hydro).

1 strip casting rod bamboo, jointless 12½ in. to 15 in. (order one extra piece for making hydro).

1 two ounce can of Ambroid.

1 two ounce bottle banana oil (for cementing paper to wings and doping spars).

1 one ounce bottle light dope (for wings).

(Note: Keep Ambroid and dopes sealed well when not being used.)

2 special para rubber motors, eight strands each (order one strip 1/16 in. balsa veneer for hydro).

You do not need any plane or extra tools, only a sharp knife, small camel's hair brush, a piece of 00 and 1 sandpaper (or fine and coarse), a foot rule or yardstick, and a soft pencil. You will need a round nose pliers and a hard steel cutting pliers if you want to make your own wire fittings. (If you have never made any, and do not care to buy them, you can make them by using the actual size drawings of these fittings as patterns. See drawing.)

Now study the drawings for just a few minutes and you are all set to start the model.

We will take up the construction of the frame, propellers, wing, and elevator. Then we will give you the data on how to make a hydro model or convert the Elliott Special into a hydro. And last, a few hints and helps on flying the models.

The FRAME is almost ready to assemble with but little work. Round the four edges of the spars off evenly. (See drawing.) If the beams are not quite straight, it will help to straighten them, but not necessary as they will pull into shape when you align the frame. It is wise and saves much time to mark the stations or locations on the sticks for the bamboo and cans by laying the sticks together and marking them together using your rule. The coats of banana oil with light sanding between coats is advisable as it makes a neater and stronger and cleaner job. Ambroid the one end of the sticks together, after cutting ends on slant (see drawing) so that they are 10¼ in. apart. Let this dry well. You can make up the bamboo pieces to sizes shown while the Ambroid is drying. Bamboo can be split straight easily by splitting the pieces in the center each time until they are the correct size or slightly larger. Scraping will then bring them to exact size and streamline them. Use the short bamboo for the short pieces, for long joints are scarce and expensive and are needed for the long pieces.

The full page scale drawing of the Elliott Special Duration Racer will be found on page 68.

Assemble the bamboo pieces onto the frame. Sharpen the ends of the bamboo and insert them in knife slits in the spars. Be sure you do not mistake the location mark for the cans for the bamboo location. Let the bamboo extend through the frame on one end only. Very carefully align frame by sliding the extended end of bamboo either in or out until the frame spars are straight when you sight along them. Then check the wide or open end of the A for correct spacing. Ambroid around the joints on *inside* of frame only, and let it dry without disturbing. When thoroughly dry (one-half hour or more) cut off the extended bamboo pieces. Make a small notch in the side of the bamboo extension and split it off, sliver at a time. Sand over this slightly and ambroid all of these joints on the outside of the frame. At the same time ambroid the front hook in place and the cans to one side of the frame, "A." Ambroid the "X" braces together where they cross Ambroid the ends of the sticks where the bearings are attached for about three-quarters of an inch as a seat to prevent the bearing from crushing the balsa and loosening. Then put the cans on the other side. The cans should line up fairly well when you sight down through them. Next ambroid the bearings in place using two coats of ambroid. Cover the ambroid each time as it loses strength and becomes unsatisfactory when left uncovered for very long.

The PROPELLERS are carved in the usual manner to dimensions given on drawing. *Do not round ends* until you have carved them down and rough sanded them. The propellers should weigh about 1/5 to 1/7 of an ounce for the pair complete with shafts. Two coats of banana oil with light sanding between should be applied, and the propellers balanced carefully. They should be 5/32 in. thick near the hub and taper to 1/16 in. near the tips. They should be so thin that they begin to be semi-transparent. An extra coat of banana oil around the edges and over the tips protects the propellers considerably. Make an ambroid seat for the shafts on both sides of the propeller same as you did for the front yoke and

(*Continued on page 87*)

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What's Doing at Washington

THE House Committee on Public Lands has reported for enactment the bill sponsored by the Department of the Interior providing for the lease of public lands owned by the United States for aviation purposes. A number of requests for public lands for use as airports have been made.

The Military Affairs Committees of both the Senate and the House now have bills under consideration to establish a separate promotion list in the Army Air Corps. The purpose of the bill is to offer more rapid promotion to aviation officers and to attract more men to that branch of the service.

Investigation by a joint committee of Congress to recommend whether the Army or Navy shall have control of aircraft for coast defense is proposed in a resolution favorably reported from the Senate Committee on Military Affairs.

The loan of aeronautical equipment by the War Department to American manufacturers and designers for research and experimentation is authorized in a bill now passed by the Senate. An amendment provides that only such equipment shall be furnished which is not available in the open market.

Congress has appropriated $1,200,000 for completing the construction of the Air Corps' new testing plant at Wright Field, Dayton, Ohio. The principal items are $320,000 for a boiler house; $220,000 for hangars, and $210,000 for a foundry, radio laboratory, maintenance building, wind tunnels, oil house and armament laboratory.

The House has passed the Naval Appropriation bill for the fiscal year 1928, which provides $31,315,000 for naval aviation. The house has also approved the naval building program, in which $19,000,000 is appropriated for an aircraft carrier, together with its fleet of 75 airplanes. The naval appropriation bill provides, among others, for the following items: $15,865,000 for construction and procurement of aircraft and equipment; $1,250,000 for navigational, photographic, aerological, radio and miscellaneous equipment; $9,675,000 for maintenance, repairs, special clothing and equipment, including $400,000 for catapults, for the various air stations and air units. The Secretary of the Navy is also authorized to enter into contracts for the production and purchase of new planes and equipment, spare parts and accessories to an amount not to exceed $10,000,000.

The Air Coordination Committee, consisting of the Assistant Secretaries of War, Navy and Commerce for Aviation, F. Trubee Davidson, Edward P. Warner, and William P. MacCracken, are studying the problem of the establishment of a uniform and standard classification of airplane accidents, both for military and commercial planes. Present methods of classification differ in the three different departments and it is expected that a uniform system will enable the services and the department to take steps to prevent the recurrence of preventable accidents, provide a basis for the establishment of rate for insurance for operators and aircraft, and to make possible a clearer understanding on the part of the public of reports of aircraft accidents as presented in the press.

Creation of a single Aircraft Procurement Board for co-ordinating government purchases of aircraft is provided in a bill which has passed the House and is now pending before the Senate Committee for Military Affairs. It would be the duty of this board to consider all plans for such procurement and make recommendations to the establishment concerned, and submit an annual report to the President showing the status of the plans, together with recommendations for a continuous and definite policy in order to promote and develop the aircraft production capacity of the nation in the interest of national defense.

The Army Air Corps will train one hundred Air Corps Reserve officers for one year, beginning July 1. Heretofore army reserve pilots have received only 15 days training each year. Applicants must have been found physically qualified by a flight surgeon within six months preceding the beginning of the tour of duty; must be graduates of the Air Corps advanced flying school subsequent to July 1, 1921; or must have had a total of 50 hours experience as a pilot of service type or similar planes, ten of them during the six months preceding application.

The new Army Air Corps four-lens mapping camera is being given a test in the making of an air map of the eastern and southern coast of Florida for the U. S. Coast and Geodetic Survey. The total area to be mapped is approximately 2,500 square miles and the work will require six weeks.

The Post Office Department has invited bids on three new air mail routes. The first will run from Chicago to Atlanta, via Terre Haute and Evansville, Ind.; Nashville and Chattanooga, Tenn., with a spur from Evansville to St. Louis, giving the latter city a connection with Atlanta and later Florida and Cuba. The second route will extend from St. Louis to Kansas City, Mo., with connections through Texas and later with Mexico City. The third route will cover the state of Michigan, running from Chicago to Kalamazoo, Mich., via South Bend, Ind., to Bay City, via Lansing, Flint and Saginaw, with spurs branching out from Kalamazoo to Pontiac, via Battle Creek, Jackson, Ann Arbor and Detroit, and to Muskegon via Grand Rapids.

Promotions and appointments in the Army Air Corps Reserve, suspended November 5, 1927, have been resumed, and all corps area commanders notified that recommendations for promotions in grades above that of second lieutenant may be submitted to the department and applications for appointment may be considered.

The new requirements for a federal airplane mechanic's license, effective May 1, are more strict than present ones. In addition to the former requirements the applicant must give the inspector a practical demonstration of his ability.

The Department of Commerce, Bureau of Aeronautics, is engaged in a survey of civil aviation from data collected by a canvass of air transportation operations.

(*Continued on page* 84)

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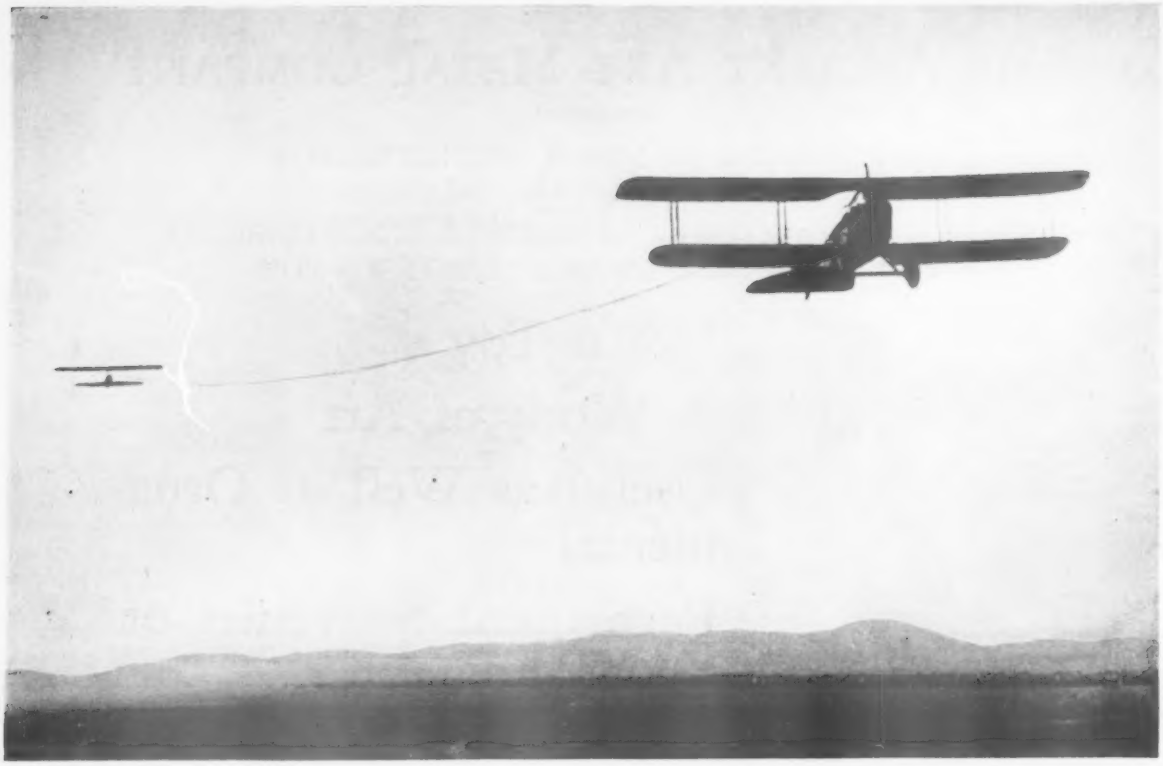


Towing Glider over Kasseler Flying Field, Germany.

Pioneers in Gliding

By John H. D. Blanke

MAN has envied the bird for thousands of years because the bird can sail, whirl, circle, glide, jump or whiz in the air just about as he pleases. The bird disregards or utilizes the various kinds of air currents about him, or he may be seriously affected by them occasionally. But nature has endowed the birds, one species more than another, with body, wings, tail, feathers and a skill specially designed to make them the natural masters of the air. What the bird has obtained by inheritance, man must attain by patient research, costly experiments and considerable sacrifice, if he wants to be a master of the air. Already man has outwitted the birds in some respects. He can fly with a greater speed and to higher altitudes due to his remarkable invention, the motored airplane. Yet man is still behind the bird in very many respects. Without the motored airplane or without the balloon, man would still leave just about all the mastery of the air to the birds. In order to be a real master and a skilled flyer, as compared with the birds, man must betake himself to the development and expert handling of the motorless flying machine.

About the year 1300 before Christ, Daedalus wanted to escape the wrath of Minos, king of Crete. As the story goes, he made himself a pair of wings consisting of feathers fastened together with wax; and he made also a pair for his son, Icarus. They both ascended into the air. Daedalus arrived safely in Sicily, having started from Crete. But Icarus flew too high and approached too near the sun, so that the wax in his wings melted; he fell and was drowned in the sea. That incident probably discouraged other would-be flyers from similar lofty aspirations until the year 1709, Gusman, a Portuguese monk, constructed a machine in the form of a bird; however, it did not rise. In the year 1736 this monk made a wicket basket covered with paper which rose to an altitude of 200 feet. Today most every boy knows how to fly and make a kite. But no strings are to be attached to the subject to be considered in this article and we will pass on directly to the pioneers in gliding and sailflying.

Otto Lilienthal generally is considered the real father of the gliding and sailflying sport, if not of the entire field of aviation. He was born in 1848 at Anklam, Germany, and constructed his first flying machine in 1864, consisting of a pair of wings fastened to his arms. The following year he built his first glider, consisting of a pair

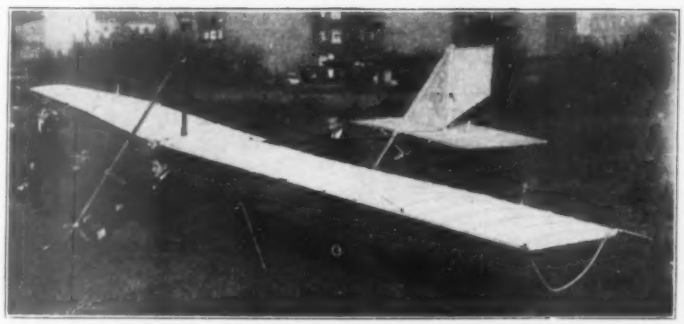
of supporting surfaces. Then he began a systematic study of the resistance of the air and in 1889 resumed his attempts in flying. First he made his attempts from a hill near Steglitz, and later, in 1890, from an artificial mound near Lichterfelde, at the same period he made also gliding flights near Rhinow.

Finally Lilienthal became so skilled that he could make his glides in air velocities of 33 feet per second, his glider being guided by simply shifting the weight of his body on the glider. Lilienthal carried out more than 1,000 glides and attained distances of 1,148 ft. at a gliding angle of 4 degrees from the hill. Then Lilienthal decided to build a motored glider. He constructed a motor weighing about 92 pounds and developing 2½ horsepower, compressed carbonic acid being used as the fuel. The wings of the glider were provided with oscillating spring joints, so they could be moved up and down by the motor. But before testing this motored glider in a flight, Lilienthal went to test a new altitude control; when he had reached an altitude of 49 feet he fell, broke his spine and died the following day, on August 10, 1896. The foundation which Lilienthal had laid, however, was the starting point for other pioneers to build upon.

The death of Lilienthal had a depressing effect upon the development of aviation in Germany, but the foreign countries showed an increase of interest. The Britisher, Percy S. Pilcher, had experimented already in 1895 with a hanger glider of 151 square feet surface area, reaching a maximum flying distance of 394 feet. Due to the many breakdowns of the wings, Pilcher built a stronger glider, having a supporting surface of 172 square feet and weighing 79 pounds. This design was too difficult to handle and a third and lighter glider was constructed with which many successful flights were made. Then Pilcher built a glider in which he placed a 4 horse power benzine motor built by himself, but before he was able to test the glider, he met death in dropping 33 feet to the ground when exhibiting a glider before the British Aeronautical Society in the year 1899.

About this time Octave Chanute made attempts in gliding near Chicago. Being too old himself, he had his assistant, Herring, try out the gliders. Chanute believed that the monoplane type of glider was too unstable and therefore he started very soon to construct biplane and multiplane gliders; he had been led to this through the attempts of Hargrave, after whom the box kite was named. Chanute's quadraplane glider, having four surfaces, carried a tail of the same width and shape as the wing surfaces. Above the fourth plane was a fifth plane or surface arranged parallel to the direction of flying. The gliding angle of this glider was to be 12 degree, which is quite unfavorable. Soon Chanute returned to the biplane with which he obtained better results; the reason for this being probably the fact that the supporting surfaces were arched at the lower side in 1 : 12 proportion as in the Lilienthal

Gliding! The Sport With Thrills



The world has sat in wonder at the tremendous feats performed in Germany in gliding. Already, gliders have remained aloft without power for 14 hours—a marvelous achievement.

Here is a sport for American youth, new—thrilling—exciting. Every boy in America should take up the sport of gliding. It keeps you out in the open. It starts you on the road toward aviation.

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glider. The glider had a net weight of about 22 pounds. Herring made about 700 flights in it without accident. With a total weight of 179 pounds, the gliding speed was about 33 feet per second and the gliding angle varied between 7 and 10 degrees.

Without having knowledge of the attempts of Chanute, and inspired by the attempts of Lilienthal, the brothers, Wilbur and Orville Wright, started their practical gliding flights in 1900. Then in the following summer the Wright brothers met Chanute. The first glider used by the Wright brothers was a biplane of the type of Chanute, but it differed in that it had a considerably larger wing surface area and differed also in the type of control.

All gliders used thus far were guided by shifting the weight of the body, but the Wright brothers used a horizontal control located ahead of the surfaces for stabilizing the glider in the longitudinal direction; and for stabilizing the glider in the transversal direction they employed their design of combined surface areas which at once eliminated the difficult problem of transversal stability. The curvature of the surfaces was 1 : 12 as in the Lilienthal gliders. Of considerable importance in attaining their successful flights was the fact that the Wrights flew their gliders lying flat on the lower supporting surface.

Their second glider, built in 1901, had a large supporting surface, this being 226 square feet. The surfaces were rectangular in shape, had a span of 20 feet and were 6 feet, 7 inches deep. The supporting surfaces were 5 feet, 7 inches apart and the curvature of the underside was only 1 : 19. There was not a single accident worth mentioning in making about 1,000 glides, which shows the skill which the Wright brothers had acquired in the design, construction and flying of their gliders. In starting the glider, two men lifted it by each holding to one of the wing ends, and carrying it swiftly against the wind until it lifted. Even at that time the Wright brothers made flights lasting two minutes.

Due to the appearance of the automobile motor, the Wright brothers came upon the idea of using one of them in their glider. And in their first motor-powered and one-minute gliding flight on Dec. 17, 1903, they pointed the way to motored flying, from which date the whole world has been interested increasingly in the development of motored airplanes. In spite of their success in the construction of motored gliders, the Wright brothers returned later to the design and testing of gliders. They recognized the fact that at that time the motored airplane was not an economical air vehicle.

The progress which the Wright brothers made in the design of their gliders from 1900 to 1903 is shown in the following table showing the figures for their four gliders, in the order in which they were designed.

No.	Width of span	Depth of surface	Surface area	Net weight
1	18 ft. 6 in.	5 ft.	168 sq. ft.	48 lb.
2	19 ft. 10 in.	7 ft.	226 sq. ft.	100 lb.
3	32 ft.	5 ft.	306 sq. ft.	117 lb.
4	40 ft. 2 in.	5 ft.	517 sq. ft.	117 lb.

This table indicates that the Wright Brothers recognized early that a narrow supporting surface of large span is better than a deep surface. In 1911 Orville Wright made many gliding flights in the dunes at Kitty Haw, lasting up to 11 minutes; at one time he remained on one point in the air for 10 minutes. Already on Sept. 4, 1904, the Wright brothers had made their first complete return glide. In the 1911 glides Orville Wright used a biplane of the old design, except that the wing surfaces were tied together, built stronger and the entire design was adapted to the new discoveries in aeronautical science. Most of the glides were made in winds of 66 to 72 feet per second velocity. Exceptional skill and ability in control were required.

Offermann experimented with monoplane and biplane gliders near Aix-la-Chapelle between the years 1908 and 1912. Later he experimented in the Eifel valley where he built an artificial mound from which he started his glider with a catapult, as Wright had done. In the year 1911 K. Pfannmueller was able to fly 1,476 feet and then in 1912 Guthermut covered 2,755 feet in 112 seconds in his biplane seat glider at an air velocity of 11½ feet per second and a flying speed of only 25 feet per second. The glider had a span of 33 feet, and a wing depth of 5 feet, the wing ends sloping backwards into a point.

From this time on many enthusiasts experimented with gliders and it would be impossible to mention all of them in this brief article and to mention anything but the most salient facts concerning the best of these pioneers.

In the year 1909 flying clubs were organized for the purpose of studying and experimenting in aviation, particularly in gliding. Necessity is the mother of invention and in the case of Germany necessity became the daughter of the Treaty of Versailles. For this treaty forbade her to build airplanes beyond a certain size and limited her development in aviation in certain other respects. Therefore the German people were forced to find an outlet for their aviatic spirit in developing the glider and sailplane. As a result, Germany has contributed the greatest of the achievements in the sport of gliding and sailflying and her aviators are pursuing their work with scientific accuracy and an intense spirit of research into the laws which underly the science of flying.

The Flugsportvereinigung Darmstadt, one of the German clubs of academy students, started their experiments in gliding near Darmstadt and later on the Wasserkuppe in the Rhoen in the year 1909. At first they employed a very simple, dismountable hanging glider, which is a type in which a person suspends himself by the shoulders or hangs in a similar way and uses his feet in shifting his weight.

Later this club built their own models, constructing 14 different gliders out of bamboo. One of these biplane gilders made average flights of 1,300 to 1,640 feet in length in the Rhoen in 1912. In the same year Gutermuth covered about 2,745 feet in 112 seconds as stated above with a bamboo constructed gilder on a shallow slope with a gliding angle of 4 degree.

In the year 1920, von Loessel, member of the Darmstadt club, built two fuselage gliders, one a bi-

plane of 24 feet span, 226 sq. ft. surface area and 95 pounds actual weight. The rectangular-shaped fuselage was 16 feet long. On August 8, he flew 1,312 feet in 40 seconds under an air velocity of 21 feet, attaining a gliding speed of 54 feet per second. On the next day he flew his biplane fuselage glider, in somewhat rough weather, slowly loosing altitude, over a slope. A sudden gust of wind from below broke his weakly constructed altitude control and he was killed in a drop of 492 feet. In this flight he had already made 2,526 feet distance in 80 seconds.

Harth and Messerschmitt built their first glider in 1910. They used a wing profile with a heavier entering edge and controlled their glides by manipulating the wings so the movement of one would compensate the movement of the other. They experimented always above nearly level ground. In 1914 they were able to maintain their glider safely in balance in an air of 49 ft. per second velocity. In the year 1916 Harth flew 3½ minutes without loosing altitude and that in an air of 26 to 33 ft. velocity per second. Then in 1920 Harth flew in the Rhoen at an altitude of 164 feet above his starting place without loosing speed in gaining this altitude, and that above a country having a 2 to 5 degree slope.

Due to the efforts of the publisher, engineer Oskar Ursinus, of the aviation periodical "Flugsport," the Deutsche Model und Selelflugverband E. V. conducted their first gliding contest in the month of August, 1920, in the Rhoen. In this contest Klemperer brought his monoplane lowplane glider "Schwarzer Teufel" to a distance of 5,999 feet in 2 minutes and 22.6 seconds. In the class of hanging gliders, Pelzner made a record of 1,482 ft. distance in 52 seconds. At this time Peschkes made glides in the Schwarzwald with a new type of tailless monoplane glider, a forerunner of the wellknown "Weltensegler." On August 18, 1920, he made a flight in the figure 8, flying twice past his starting place at 20 to 26 feet altitude, covering 1 1/5 mile in 2 minutes.

No Temporary Licenses

No letters of authority granting to applicants all the privileges of licensed pilots and mechanics will be issued by the Department of Commerce after May 1. Under the old air commerce regulations such letters were issued pending examination of applicants but under the new regulations now on the press, the practice will be abandoned as the Aeronautics Branch of the Department has learned by experience that too often, where an applicant has received such temporary authorization, he does not bother to take the prescribed examination for a regular license. This has caused considerable difficulty to the licensing division because it has frequently been found impossible to locate such applicants again. Under the new regulations applicants for pilots' and mechanics' licenses of all classes must wait until after they have been examined and regularly licensed before they are accorded the privileges of such licenses.

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Navy Training Plane

THE Curtiss "Fledgling," a new training plane for the United States Navy, has just been successfully flight tested at Mitchel Field, N. Y.

The Fledgling, which bears the Navy designation XN2C-1, is a two-seater biplane powered with the Wright J-5 engine, and intended for use as both a primary and advanced training plane. Three planes of this type are under construction for the Navy by the Curtiss Company, as the result of a design competition held last year, which was won by the Curtiss Company from a field of fourteen competitors, including most of the well-known manufacturers of military aircraft.

Special attention has been paid in the design of the Fledgling to the requirements of advanced training, including fixed gunnery, flexible gunnery, radio "spotting" and bombing. Two fixed Browning machine guns are mounted in the fuselage, firing through the propeller and operated by triggers on the control stick. In the rear cockpit provision is made for the installation of a flexible gun ring for Lewis guns, and regulation fire steps for the gunner to stand on are provided. The entire gun installation has been patterned after that of the Curtiss Falcon observation plane, which has proven highly satisfactory in actual service. For bombing training, provision has been made in the rear cockpit for the installation of a bomb sight and for removal of part of the flooring for sighting. Standard bomb racks can be fitted to the lower wings. The rear seat and control stick can be readily removed from the plane when it is not being used for dual instruction. Provision is made aft of the rear cockpit for the installation of a radio set, and there is a small auxiliary folding seat for the observer's use when radio "spotting." Structural details include a welded chrome-molybdenum steel tube Warren truss fuselage, fabric covered, with a detachable welded steel motor mount. All control surfaces are of welded steel tube construction, fabric covered. The wings are of wood, using routed spruce spars, latticed spruce and birch plywood ribs, and fabric covering. The interplane bracing is of the two-bay type, with streamline steel struts and streamline wires. Landing gear is of the axleless type, using a combination of oleo and the well-known Curtiss compression rubber disks. This arrangement has proved highly satisfactory in test flights, operating with exceptional smoothness, both in landing and taxying. The tail skid is steerable and uses rubber disks as the shock absorbing medium.

The Fledgling is designed to be convertible as a land or seaplane. The seaplane landing gear consists of a single main float and two wing-tip floats, all of good framing, covered with mahogany planking.

Some Prize Money

The Williams Flying Service of Spartanburg, S. C., is planning to hold an air meet in Spartanburg in the near future, with about $2,500 in cash and ten loving cups as prizes. The Service won five out of seven events at the February meet held at Macon, Ga. They are building an eight-ship hangar on the municipal field at Spartanburg, which will be the headquarters for their Eaglerock distributing agency.

A Real Barnstormer

The S-29 of Roscoe Turner, of Richmond, Va., has perhaps had a more varied life than any other transport plane in the country. It has broadcast radio programs from the air, been a piano mover, a flying cigar store, a clothing salesman, and has appeared in the movies. Turner piloted her in Hell's Angels, one of the war pictures lately made.

On the way to Hollywood Turner hit some rough air near El Paso, the mechanics and the tools hit the top of the cabin, and he fell into the controls. The big Sikor-

sky took a thousand foot nose dive with the motors full on. Except for changing one spark plug, which blew out over the desert in Arizona, no trouble was experienced on the trip. Turner operates the R. T. Flying service at Richmond, Va., and is the Waco distributor for the state.

Proposed Airports

Establishment of municipal airports is being considered by 19 more cities, according to the Aeronautics Branch of the Department of Commerce. They are:

Holly, Colo.
Springfield, Colo.
Ocala, Fla.
Waycross, Ga.
Columbus, Ind.
Council Bluffs, Ia.
Chariton, Ia.
Cresco, Ia.
Baton Rouge, La.
Hagerstown, Md.
Corvallis, Ore.
Knoxville, Tenn.
Fort Stockton, Tex.
Barre, Vt.
Newport News, Va.
Farmville, Va.
Martinsburg, W. Va.
Marshfield, Wisc.
Sheboygan, Wisc.

Elimination of Noise

The Army Air Corps is experimenting with noise, or with the elimination of noise, but thus far has made no definite progress from the military point of view, according to Major General James E. Fechet, Chief of the Corps. For several years the experimental laboratories of the Air Corps at Dayton, O., have been conducting tests with a view of eliminating the noise occasioned by a plane in flight.

The problem as it confronts the Army, General Fechet explained, is that of entirely eliminating the noise, because lessening the racket of the plane would have no material benefit in attack. If the attacking plane could be made perfectly silent in operation, he pointed out, it might be capable of surprising the enemy and carry out its mission before being detected.

The tests to eliminate noise thus far have centered around the muffling of the engine of the plane but General Fechet pointed out that the greatest source of the din is from the propeller and that this presents the real problem. Mufflers for the engine have proved effective to a degree, he said, and should aid commercial aviation in that the moderation of engine noise permits conversation in the plane.

Regarding engine noise, General Fechet stated that the application of a muffler necessarily reduces the horsepower of the engine but not to an appreciable extent. A poor muffler, he said, cuts down the horsepower about 5 per cent, and results in a somewhat damaging loss to the efficiency of the craft, but with the proper kind of muffling, the loss in horsepower probably would be not more than one-half of one horsepower.

General Fechet stated that the experiments are being carried on at the Air Corps' new laboratories at Wright Field, Dayton.

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Mental Cure for Vertigo

(*Continued from page 20*)

inside the cockpit, which is entirely surrounded with the recently developed unbreakable glass, make occasional adjustments of the instruments to maintain their position and altitude. They do not notice the fog outside; the cannot see their own wings more than a foot from the windows. They don't care to. One man watches the bank-and-turn indicator and moves the controls to keep the plane in level flight. He also moves a control occasionally to keep the plane flying dead ahead.

From the next field, some fifteen hundred miles away, a steady radio beam is cast, which emits a low hum in an organized cadence within the annunciator box in the pilot's compartment. On this beam, the crew keep the plane flying steadily. If it drifts too far to the right or left, they immediately pick up the difference and get their plan back on the main beam.

The ground stations are aware of storms in the path of the plane, and if they judge the storms to be too heavy for the plane to buck, they radio ahead to the beam station, and that station moves the beam slowly, so the plane crew can follow it, and it drifts the plane around the course of the storm, so as to avoid it., The plane crew know nothing of this; they are in night and fog, and they blindly follow their beam.

But they know something of their location. On their instrument board is their capacity altimeter. This instrument is built on the principle of an electrical condenser, such as used in every radio set, but one plate of this condenser is in the plane and the earth is utilized as the other plate, charged oppositely. Naturally, even the slightest change in the position of the plane in relation to the earth will cause an electrical impulse in the meter, which can be read by means of a needle in the pilots' compartment.

Our pilots know they are to pass over the Rocky Mountains, so they have set their altitude at a safe height, to pass over the highest crags in safety. Suddenly, they note their capacity altimeter begin to rapidly read down, then up, then down again. They know by this that they are passing over the foothills of the Rockies, and when the altimeter becomes still more rapid and emphatic in its readings, they realize they are at last well in the midst of the Rocky Mountain system, for the capacity between the ground and the plane changes as each hill and valley comes under the aircraft.

While the capacity altimeter reads the exact distance above the earth, a subsidary barometric altimeter gives the exact distance above sea-level at all times.

The pilots have little to do beyond remaining on the alert to keep their plane on its course following the beam. Most of the minor corrections of the plane to keep it in a level position, such as are made now by the pilot with the stick, the rudder bar or the aileron control, are made by pressure exertable with the little finger. For, in addition to his equilibrium flying principle, Captain Ocker has also developed additions to the plane itself. For instance, there are small rudders attached to the same axis as the large ones, so that when the plane is in steady flight, this small rudder may be moved instead of the main large one. Similarly for the ailerons, where small ailerons, on the very wing-tips are used in flight, instead of constantly tugging on the main aileron, which extends for about a third of the wing's length.

One of the passengers, noting that the ship does not appear to be moving in the night, anxiously inquires of the assistant pilot if the plane might stall. The assistant pilot immediately smiles and indicates that a stall is quite remote. If it were to occur, the wings contain slots which may be opened from the cockpit and which, with the proper operation of the controls, will cause the plane to settle quietly to the earth. A crash is quite impossible, the passenger is assured.

The night is now well on and the hours pass. Still the fog does not disperse, and when Omaha, Nebraska, is in the vicinity, the pilots begin to arrange for landing.

They are about one hundred miles away from their terminal when they open radio-telephonic communication with their field.

"Come in at a hundred feet when you pass first balloon beacon," they are informed, "and then settle to the

ground at the second beacon. We have twenty-four feet ceiling under fog, wind is southeast and field will be clear on the ground and aloft."

At fifteen miles from the field, they begin to drop out of the radio beacon which has guided them over the mountains to Omaha. They pick up the first balloon, illuminated by fog-piercing beacons, and now have their bearings as the second balloon looms ahead. They settle to less than twenty-four feet and suddenly pop out of the fog. It is a simple matter now to "set her down" and as the wheels stop rolling as the brakes take hold, the passengers, who have enjoyed a night's rest, begin emerging from the ship.

All along the way, under the proper organization of airways, they could have come down in similar fashion in case they had trouble of a serious nature. How different from the present day when airways are taken haphazardly and "airport" means merely a municipal field with elementary "service" available. And yet, every device here mentioned is in actual use today in some nation, only needing a mind to collate them all and put them to use on a single air line. There is a vast difference to all concerned whether a pilot shall take to his parachute because he does not know what's beneath him to land on, or whether a simple radio telephonic conversation will tell him exactly what is there and how he may land.

Ground co-operation with the air is an needful for its success as ground co-operation with other transportation services. With the available devices now in actual use and the Ocker-Myers system to insure the equilibrium of flight, the entire needful paraphernalia for an airline which could be rendered safer than any other form of transportation is now at hand.

Hitherto, there has been reticence about providing the other devices here named to all air lines because the owners have generally thought there was little use for them in view of the fact that pilots could not fly through extensive fog anyhow. With the Ocker-Myers flying system in existence, the other arrangements are practically forced in general use, and the first line to install such a system will find itself amply repaid by the public business.

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Five States Lead

Five states are far in the lead in aviation activity, judging by the records of the Aeronautics Branch of the Department of Commerce. In the order named, they are California, New York, Illinois, Michigan and Texas. Temporarily at least, more airplanes carry federal licenses in New York than in any other state. The number is 118. Illinois is second with 94 and California third with 68. In Missouri, 53 planes are operating under federal license; in Ohio, 38; Kansas, 33; Texas and Washington, 32; Oklahoma, 27; and the District of Columbia, 26. In other states less than 25 planes each have been licensed.

Although both Illinois and New York now lead California in the number of licensed planes, temporary numbers have been assigned to 254 planes in California, practically all of which will receive licenses when inspected. The number of inspectors on the west coast has been increased from two to four to take care of the flood of applications. There are now 23 inspectors on duty in various parts of the country and the number will shortly be increased to 28.

In addition to California, there are many other states in which planes now operating under a temporary number, wait inspection and license. In New York there are 78; in Texas, 61; Illinois, 59; Ohio, 49; Pennsylvania, 46; Indiana, 42; and Michigan, 40. Lesser numbers are on the waiting list in other states.

There is another classification which tends to indicate the comparative growth of aviation in the several states. This is the record of airplanes registered with but not licensed by the Department of Commerce. California leads this group with 134 identified planes and Texas is a contender with 111. There are 72 identified craft in New York, 62 in Illinois and 59 in Michigan. In other states less than 40 planes each have been registered.

The Aeronautics Branch of the Department of Commerce reports that 3,362 applications for airplane licenses have been received to date. Licenses have been issued for 1,243 and 1,064 applications are pending. Only 193 applications have been disapproved because of failure to pass inspection. Cancellations, both of applications and licenses, number 862.

The large number of cancellations is explained by the fact that when an airplane for which license application is made fails to meet the qualifications for such a license, the application is cancelled and in lieu thereof, application is filed for an identification number. Another contributing cause for cancellations is the failure of the pilot of the plane to qualify for a license, and as the air commerce regulations provide that an unlicensed pilot cannot fly a licensed plane, the application for licensing the plane is cancelled.

The number of applications for identification of craft, as distinguished from licensing, is 1,193, and of this number 1,073 have received identification numbers or, in other words, have been registered by the Department of Commerce.

A FEW years back a lad from the Arkansas foothills returning from his first visit to a big city told his father and the neighbors who gathered to hear, of the wonders he had seen.

He told of getting in a little room in a big building, and of the room cutting loose from its moorings and going straight up, stopping at any floor. He told of a night which was brighter than noonday, and other miracles. He got by all right until he mentioned a machine which rode men like a winged horse through the heavens.

His good old pappy at this juncture arose with fierce disgust in his eye and said: "Son, we'uns are all your friends and you're lying to us! If God wanted man to fly he would have given him wings!"

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REVELATION AIRCRAFT CO.

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Washington News

(*Continued from page 72*)

The Census Bureau is making a census of production in the aircraft industry for 1927, the first complete year since the government has systematically undertaken the promotion and regulation of air commerce.

The U. S. Bureau of Navigation has decided to test a fog-piercing lens with a view to adaptation for both water and air navigation, by installing it in the lighthouse at Portland, Maine, where fogs are prevalent.

The Bureau of Standards is conducting research work on reducing the noise in airplanes. Experimentation so far has been confined to material for cabin walls, and the most effective combination having a permissible weight consists of two thin sheets of aluminum between which is held a thick sheet of light, fluffy material.

Congress has enacted the bill providing for the transportation of air mail to foreign countries. The Postmaster General now has authority to contract for air mail service to Canada and Mexico at a rate not to exceed $2.00 per mile.

The House has passed and sent to the Senate the bill establishing five cents an ounce as the new minimum rate of postage on air mail. The bill gives the Postmaster General discretionary authority to make progressive reductions to this point when and as warranted by the volume of traffic.

The Navy Department has awarded its first contract for a monoplane type flying boat, the first twin engined monoplane that the Navy has ordered for patrol duty, to the Consolidated Aircraft Company of Buffalo. It will be equipped with two direct drive "Wasps."

A bill authorizing the Secretary of War to transfer or loan aeronautical equipment to museums and educational institutions has been passed by the Senate and sent to the House. A similar bill affecting the Navy was passed last session. Such equipment must be obsolete or beyond economical repair and cannot be used for actual flight.

Atlanta-New York Route

Seventy-eight rotating beacon lights spaced approximately ten miles apart on the New York-Atlanta airway have prepared the route for night flying.

Each light along the air highway from New York to Atlanta is two feet in diameter. Nineteen of the rotating beacons are located at intermediate fields, with the usual boundary lights, illuminated wind cones and obstruction markings where required.

The logical routing of the airway necessitated the locating of several of the beacons at points where commercial power was not available, and at each of these points duplicate automatic engine-generator sets were installed. The operation of these sets is controlled by an automatic time switch in such a manner as to provide for alternate operation on consecutive nights, the idle set on any night functioning upon failure of the operating set.

President of Cuba Flies

By Ulpiano R. Muniz

AT nine o'clock one morning early in March President Gerardo Machado of Cuba officially inaugurated the Army Flying School at Camp Columbia, by giving a demonstration of his interest and confidence in aviation when, without previous advise or ceremony, asked Lieut.-Col. Mesa to let him fly in his place on the observer's cockpit of one of the PT3 Consolidated Training planes of the school's equipment. General Machado further refused to wear a parachute, and thus was aloft, with Captain Laborde, of Fokker fame, for over twenty-five minutes, circuling and making some acrobacies that other person not so air minded would not have cared to let the pilot do. The president, upon alighting from the airplane, was joyful and satisfied and told the air staff of the army that he hoped the school existed forever to let the Cuban wings spread far and wide the love and appreciation of this little country of ours. He further re-assured the army that before the end of the year we would have five to ten more units, in order to make the sky safe for Cuba. It certainly is commendable to hear an executive speak that way, the way all executives of America should, for America's supremacy in the air is paramount for the preservation of our freedom and our friendship.

The school is a single story building of old Spanish castle architecture, with class rooms, laboratory, offices, etc., and comfortable quarters for 25 pupils, which is the number that has inaugurated the first coarse of the Army School. The flying equipment consists of four Consolidated PT3's, Wright J5C powered with Hartzell steel propellers, and so forth. In order to make the pupils go through as complete a training as if he had gone to Kelly or McCook fields, the whole army air force equipment has been turned over to the school, and the prospective pilot will have lots of practice with the light Vought UO's observation planes and the big DH, Liberty engined bombers.

The course will last one year, and comprises: Military training; preservation and care of air equipment; aerodinamics; parachute jumping; radio and telegraph; airplane instruments; motors; rigging and aligning airplanes; maps; navigation; metereology; machine guns; sights and synchronizers; International Aerial Regulations; bombardment; pursuit; A. A. guns; bomb racks; bomb throwers; aerial tactics; signal communication; duties of officers in squardrons; reading of aerial photographs and visual reconnaissance.

The direction and professors are: Director, Commander Ovidio Ortega, chief of the air corps; secretary, Captain Medina Menier; advisors, a mission of the American Army composed of Lieut. Gillespie, Lieut. Hodgson and two sergeants; Captain E. Laborde, chief of flight; Lieut. D. Ravelo, director of cadets. Lieut. A. Gutierrez, quartermaster; F. Lopez Neyra, engineer; Physician J. A. Torre. Navigation, Cuban Navy Lieut. Oscar Rivero, radio and telegraphy, Lieut. Pablo A. Rosado, of short wave fame; Captain Cancio Bello and Lieuts. Ponce de Leon and Morlote, of Kelly and McCook field, and Lieut. Fernandez Collazo.

Further to the inauguration of the school, it was proposed that the Cuban Army and Navy Reserve Forces be admitted to training and use of the field at camp Columbia, and everything points out to a satisfactory permission.

At the request of the Cuban Government, the War Department has sent a mission, consisting of one captain, two first lieutenants, and two enlisted mechanics of the Army Air Corps, to Cuba for the purpose of assisting in the organization of an aviation school in the Cuban Army.

Captain Rosenham Beam, Air Corps, formerly on duty at March Field, Riverside, California, has been designated to head the mission. He has been relieved from his present station and directed to proceed to the Air Corps Training Center, Duncan Field, San Antonio, Texas, for the purpose of conferring with First Lieutenant James M. Gillespie, now stationed at Brooks Field, San Antonio, Texas, and First Lieutenant Jack C. Hodgson, now stationed at the Air Corps Training Center, Duncan Field, San Antonio, Texas, who have been designated as the other officers to compose the mission. Upon completion of this conference, Captain Beam proceeded to Havana, Cuba, and reported about January 1, 1928, to the Military Attache, American Embassy, at that place, for further instructions. The other two officers of the mission reported at Havana later.

The enlisted personnel of the mission will consist of Master Sergeant Joseph Biando, now stationed at Marshall Field, Fort Riley, Kansas, and Master Sergeant Conrad L. O'Briant, now stationed at Kelly Field, Texas.

Sweden to Hold Exhibition

An international aviation exhibition will be held at Goteborg, Sweden, this year from May 17 to 20 under the auspices of the Swedish Aviation Club. It will be open to foreign manufacturers of airplanes or seaplanes. Foreign aviation clubs are also invited to participate.

The program includes both exhibitions and practical demonstration of flying machines and also competitions in which the speed, fuel consumption, stability, etc., of the various makes may be demonstrated. Where proximity to Sweden of the countries participating will permit of participants flying direct to the exhibition, it is also proposed to arrange a race between a number of exhibitors. The finish of this race and the arrival at the flying ground of the competing planes will be one of the opening events of the exhibition.

According to the promoters, American participation is specially desired, interest in the progress of airplane construction in the United States having been greatly stimulated by Colonel Lindbergh's successful flight over the Atlantic and still further animated by the fact that Colonel Lindbergh is of Swedish descent.

The city of Goteborg has the largest flying field in Sweden. It is located at Torslanda, about 12 kilometers from the center of the

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26x4 wheel $8.50 or with fabric streamlines $10.00 Aluminum streamlines $4.50 per wheel. Dandy, unused 26x4 tire $7.50 or slightly used $5.00 or moderately used $3.50. New tube $2.25. 750x125 wheel $8.50. Aluminum streamlines therefor $6.50 per wheel. Dandy unused 750x125 tire $10.00, or unused, passable tire $7.50. Surplus unused tube $1.75 or new production tube $3.50. 700 x100 tires $10.00.

Log books: Pilot 50c, engine 50c, airplane 75c. All three in one binder $3.00. Booster magnetos $15.00.

Protector goggles $5.00. Luxor No. 5, $7.50; Luxor No. 6 $9.75. Italian goggle tte $3.50. The following are nonshatterable goggles: NAK, wide-vision $4.00. DG $4.50. RAV rubber padded $4.50. Jumbo oval $2.50. Gosport two-way speaking tubes with O.D. helmets $12.50 or one-way speaking tubes $6.50. Set of three navigation lights $6.50.

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city, on the north side of the Gota river and opposite Langedrag. A newly built road connects the flying field with Goteborg and there are regular means of communication between Goteborg and the field by boat, omnibus and automobile.

The field is a combined flying station for both seaplanes and airplanes. The dimensions of the field are 600 by 400 meters, and the seaplane harbor is well protected against all winds, with wharves and slips adjoining the hangars, the dimensions of which are 60 by 28 meters, and which are intended for both types of planes. There is a customs station and repair shop on the flying field, in addition to which gasoline, oil and fresh water are available. There is also a restaurant on the field, where both single meals and board may be obtained at low prices.

Airplane Racing

(*Continued from page* 13)

know more about speed than those of any other power. And speed changes, the speedy ship of a few years ago is just an old crate today. And speed is not the only requirement to be sought for in airplane racing. At the National Air Races held each year (Spokane, 1927; scheduled for Los Angeles, 1928) there are races for every type of ship from the light "air flivver" to heavy transports and bombers. There are competitions in climb, weight carrying, and efficiency for service and for commercial aircraft, and there are "Air Derbies," wherein planes operate under commercial conditions with a specified load over a definite route.

Airplane racing should and will mean to the airplane industry what automobile racing and road tests mean to the automobile industry. Racing is a supreme competitive test before the eyes of the world and it carries with it an incentive that does not exist in normal flying work. There are no after-thoughts in racing, no stone must be left unturned that might gain a victory. It is an invigorating stimulant to aviation and it will continue to play a vital and important part in the development of aircraft.

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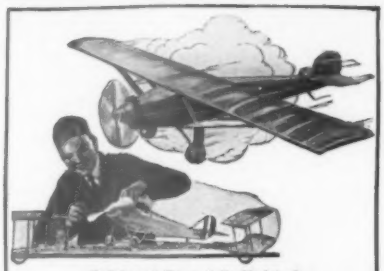

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Elliott Duration Racer

(*Continued from page 70*)

bearings on the frame. Be sure to get the shafts in straight. They can be pushed right through the balsa without any drilling. Bend a U in the end and push it into the hub so that the shaft will drive the propeller.

The WING is the next thing to make. You only need to round the edges of the spars slightly and give them two coats of banana oil. If you wish you can bend the wing tips in a curve as shown in dotted lines. (A very hot soldering iron or bar you will find a help here. A flame can be used but it is too easy to burn the bamboo and spoil the piece.) If you make a full size drawing of one-half of the wing, you can assemble the two halves on top of this pattern.

Note the edge or front view of the wing and see that you get the correct angle or height at tips; ¼ in. off on either side will not spoil the wing but get it close as possible to the drawing.

Paper just a few inches at a time, starting with the center and using a piece of paper only an inch or so larger than needed. Banana oil the spars for a few inches and then quickly work any wrinkles out, using thumbs and fingers of both hands; slip the paper outwardly with an outward motion of your thumbs. (See drawing.) When all papered, trim the excess off closely with a razor blade or sandpaper and stick the edge down with banana oil. Then if necessary dope the wing lightly and evenly using a ½ in. soft brush. Good dopes are liable to warp a wing by shrinking paper tightly. If the paper is on smoothly, do not dope it as you might have a crooked warped wing. (To shrink the paper and iron it before using is a good plan. See hydro data at end of article.)

The ELEVATOR is constructed on a new light weight principle. It was originated by the model editor and Mr. Elliott has made several elevators this way. It saves considerable time and makes a neat elevator. Use a strip of 3/64 in. or 1/16 in. thick balsa

When you build model planes and gliders, use Balsa Wood

Commercial builders make their planes from Balsa Wood — it is the lightest wood known, yet weight for weight strong as pine. Its resiliency like that of spruce. We have Balsa Wood pieces cut in special widths for the builder of model planes and gliders. Prices as below.

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36"	6"	2"	$1.25
36"	6"	3"	1.75
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3 foot length of	Spruce	Balsa	Bass.
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1/16"x1"		.08	
1/16"x1/2"	.03	.03	
1/16"x1/4"	.045	.054	
3/32"x1/2"	.039	.045	
3/32"x1"	.048	.054	
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1/8"x1"		.084	.075
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Ambroid dope, 1/4 pint	$.50
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Bamboo paper, 24 3/4"x23 3/4"	.14
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28, 30, 32 wire, per spool	.10
1/8" Copper Washers, two for	.01

Also bolts, nuts, screws, brads, etc.

veneer 5/8 in. wide as shown in drawing for the tips. This eliminates the use of heavy bamboo where its strength is not needed. Of course the leading and trailing edges are of bamboo. The bothersome bamboo bending is eliminated as well. It is desirable to give these ends a coat of banana oil. Note how the front edge of the elevator appears as this is important to have more angle or greater height in the front tip than in the rear tip. Paper the elevator in the same manner you papered the wing.

Now we are about ready to fly! Building the model was a very easy and simple job, considering the flying qualities of the model.

Hydro Data

Let's see how simply we can make a hydro out of the Elliott Special by using a set of Mr. Pond's style of pontoons same as used on his World's Record Hydro (172 seconds made at a hydro contest at Lake Calumet, near Chicago, several years ago) with a model very similar to Mr. Elliott's machine.

It will be necessary to dope the whole frame and the propellers carefully with one good coat of hydro dope.

A larger elevator will be necessary to get good results. Make it in the same manner as the hand launch elevator but 3¾ in. wide by 13½ in. long to supply a little more lift in front.

The paper for the wing floats and elevator has to be shrunk before using in the following manner. String a sheet of paper on a piece of cord (see drawing) by one edge. Dope quickly with light dope. Then when dry, wet it thoroughly and let it dry again. Then iron it out on a smooth piece of paper with a regular hand clothes iron. Then, to get a really good job, banana oil it and wet it again and then iron it again. This makes a wonderfully strong light and waterproof hydro paper.

FLOATS. Follow the drawings closely and you will have no trouble with the floats. When the floats are papered, give them a coat of hydro dope and water test them for leaks. Suck out through a pin hole any water which may leak in and seal the pin hole and leak with a touch of hydro dope.

Note that the floats are light, fully streamlined and easily made. They have a "V" bottom when first starting off and then the rear edge is a straight planing edge for a quick take off. They are semi-wing section in shape (see side view) and lift their own weight when in flight. They should be set at 3 deg. to 5 deg. angle.

To make the model easy to carry, the float struts can be made to slip into sockets and can be assembled and taken apart readily. Make these of several coats of ambroid over paper wrapped around a smooth 1/16 in. dia. nail. Pull out the nail when thoroughly dry. Trim the sockets off even and fasten them in place. You will need 4 sockets for the front and three for the rear. The front floats should be attached 15½ in. from the nose and the rear float attached at the center of the "X" brace and at the rear end of the "X" braces. (See drawing.)

Flying

There's where the fun comes in, and we must know what to do to make them fly for even the best plane or model will not fly if the balance is off. Assemble the wing and elevator to the frame using long slender rubber bands. You may need help on the wing but rubber bands are better than any other method, unless a tedious wire clip is used.

Slip the propellers in place. It is better that they turn up in the center rather than down. Make up the eight strand rubbers so there will be just a little sag between the cans and assemble it onto the "S" hook and propeller shaft.

Look at the surfaces to see that they are square with the frame. Then you are ready for a trial glide in a quiet place. If the model noses up and settles back, shift both surfaces forward a little, or back if the nose drops quickly. The machine should hover along slowly at a good glide angle when the correct adjustment is found. Watch carefully so that you do not puncture the pontoons.

Then take a trial flight with about sixty to eighty turns of a 4¾ to 5 ratio double winder.

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(Copyright)

Flying Model

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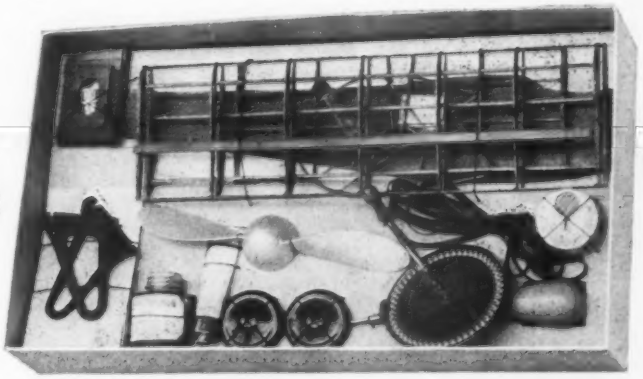

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Floats (May Delivery), per pair	4.00	4.00

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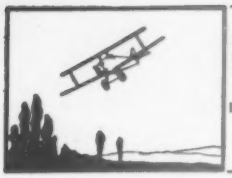

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Have you ever stood on top of an OX motor on a cold windy morning and tried to pour oil into the engine? That must have taken an hour and you were nearly frozen. THINK! Set a 5 gallon can of oil on the Heath Oil Filler and instantly your troubles are over.

Heath Airplane Co., Inc.
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(Make a winder from a large Dover eggbeater if you do not have one.) Take a hand launch trial with the hydro over land if convenient. If the model climbs without stalling you can wind 150 to 175 turns with the winder and make a real flight. Stretch the rubber about four feet at the beginning of winding and move in as you wind.

CAUTION. The cans are what make record models. Be careful to hold the nose of the ship while you hook on the "S" hook after winding and get the rubber slipped into the cans before your frame buckles up. It will not do so with the rubber in the cans.

Launch the model nose into the wind—either hand launch or R. O. W. (rise on water) and row or *run like everything* if you don't want to lose your model in the distance.

(Sight the model on some distant object if it goes too far away from you. his will help you to find it,)

Don't Give Up the Ship

(*Continued from page* 23)

and buried his face in the yielding mass of mess jackets and scented handkerchiefs. The plane crashed right in the top of a giant algeroba and then fell to the ground. Out jumped the pilot and his passenger, the former with a black eye and scratched cheeks. As for the latter, he had the leg of a pajama over his head, but not a scratch marred his coat of Waikiki tan. And he kept his date that afternoon.

A pilot flying along the Mexican border found himself in the same situation as the boy who stood on the burning deck. Shortly after taking off from Fort Ringgold, Texas, the rear carburetor connection broke, spraying gasoline all over the plane. In less time than it takes to tell it the plane was a mass of flames. Far from becoming panic-stricken, the pilot sideslipped his plane down 800 feet and made a safe landing. The intense heat destroyed the engine and damaged the airplane beyond repair. This pilot was not equipped with a parachute, otherwise he would have deserted his ship in a hurry.

Two other Army airmen on patrol duty had a very exciting experience while flying over the desolate country along the Mexican border. They were returning from Kelly Field and while flying over a very rough strip of country the temperature of the radiator started mounting. With not a single open field in sight it was very doubtful whether the plane could have been landed without disastrous results. So the airmen kept on flying with the hope that springs eternal within the human breast. For ten minutes the motor was kept running without any forced water circulation in the cooling system, while steam shot from holes in the radiator which had already spread apart in several places due to the high pressure within. At the end of that time a very small field was located, and the pilot managed to sideslip the plane to the ground without serious damage. Upon examination of the plane it was discovered that the nut which holds the fans of the water pump in place had dropped off, allowing the shaft to turn without forcing the water through the cooling system of the engine. The sides of the radiator had bulged out until the cone was torn apart in several places before it bursted. The bursted radiator was within a few millimeters of the revolving propeller, but, as the saying goes, a miss is as good as a mile.

The few incidents recorded above give some idea of the various forms of adventure which an airman may experience at one time or another but, so long as he carries his parachute along with him, his heart need not be greatly troubled.

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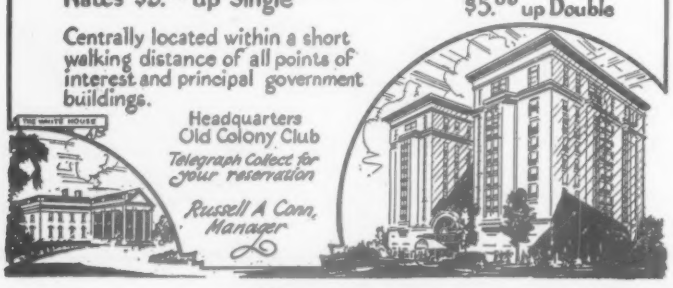

Oakland Air Terminal

(*Continued from page* 36)

enty than ten years of roof-shouting would accomplish.

Will Rogers, the ex-mayor of Beverly Hills, made a round trip across the continent in four days and said, "If your time isn't worth anything, you might as well walk."

It is difficult to erase the bitterness of a past performance, especially the one that was so deeply impressed on the minds of the countless thousands who attended the start of the Dole race at Oakland airport last August. Colonel Lindbergh in his tour of the country did just that thing when he landed at the port. The same thousands crowded the field and shouted themselves hoarse for "Lindy" and the thing that he represented—aviation. He erased, in one moment, the pall that hovered over the great field and permeated the atmosphere with new hope and new life and gave those assembled an idea of what the future held in store.

Since that eventful day of September 17, 1927, Oakland Municipal Airport is steadily forging to the front. The Boeing Air Transport Company, carriers of the transcontinental mail, base at the Oakland field. This company promises a twenty-one hour service from San Francisco to Chicago and thirty hours to New York. The 1,950-mile course to Chicago is said to be the longest commercial air route in the world. As soon as the Department of Commerce completes the lighting of airways between Oakland and Salt Lake City the airmail company announces that it will inaugurate a service of two planes daily.

The American Railway Express Company has established and operated a transcontinental air service since last September. It can be said that big business bases speculation on solid foundations. The company has cut the delivery time from New York to Oakland from four to two days.

The Pacific Air Transport, carriers of the western mail and operating along the Pacific coast from the Canadian to the Mexican border, bases at Oakland. This company lately merged with the Boeing Co.

The Western Air Express, now operating out of Los Angeles, announces that it will extend its line into Oakland airport with a fleet of Fokkers in April.

The Tri-State Airlines, offering a new passenger and express service, has made its headquarters at the Oakland port and announces that it will serve the cities throughout the Sacramento and San Joaquin valleys.

The Maddux Lines, using tri-motored, Ford-Stout transport planes, plan on making Oakland the terminus for a line extending through the southern cities and states to El Paso, Texas.

The Aerograph Company, a photographing and mapping concern, operates exclusively out of the port.

To expedite airport development the pilots and operators have formed an association which is working hand in hand with the Port Commissioners and G. M. Turner, airport field superintendent.

It is difficult to keep abreast of progress in California aviation. Oakland airport will not be a year old until next July.

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We Take a Trip

(*Continued from page* 16)

In ten minutes we were ready to leave and arrived at Reno at 10:40. Twenty minutes later, with C. K. Vance as pilot, we left Reno for what is the most beautiful part of the trip. Mountains, wind-blown clouds, deep valleys, hills, and that gem of a lake, Lake Tahoe.

Then over the last of the hills, and over the green flats, and it's warm, with some real sun. No, it's hot. This is the real estate man's Paradise. The only place where they do not have to lie—much.

Vance has a phone rigged up with the cabin. It's a one way affair, he can talk to you, but you can't call him back. He tells his passengers about the country as you fly over it.

At Sacramento, at 12:05 we dropped the mail and then were off down the river, past more flats and a few mere knolls, comparing them with the hills around Cheyenne.

Here's Oakland Airport at 12:35, and it is some airport. Well, here I am, better than two thousand miles away from Chicago, ready to go to work, and I have lost only a half a day. In spite of the forced landing and the consequent loss of time, the bad weather and all of that, I'm certainly ahead of the time game right here.

You might make fifty such trips and never run into the combination of circumstances that made me late. But if you did, you would come out of it with the same idea. Every one of the pilots is a real flyer, and there is only one thing that he thinks more of than getting the mail through on time—and that is the safety and comfort of his passengers.

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Radio Direction Finder

(*Continued from page* 27)

the Bureau's beacon station at Bellefonte, Pa. Establishment of stations at other airports throughout the country will be made later.

One of the problems still to be worked out is caused by the discovery that radio fading sometimes causes slight shifts of the indicated course at night at distances over 50 miles. This effect is at its worst over mountainous regions where the beacon is most needed. One solution under consideration is placing the beacons closer together, less than 100 miles apart. This may have some other advantages, allowing greater simplicity and reliability. This night variation may be greatly reduced by the new short antenna but this remains to be investigated.

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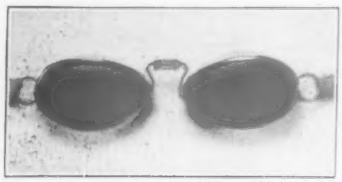

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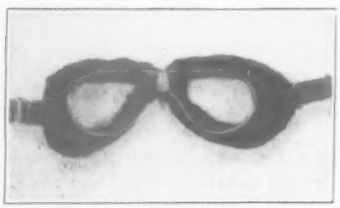

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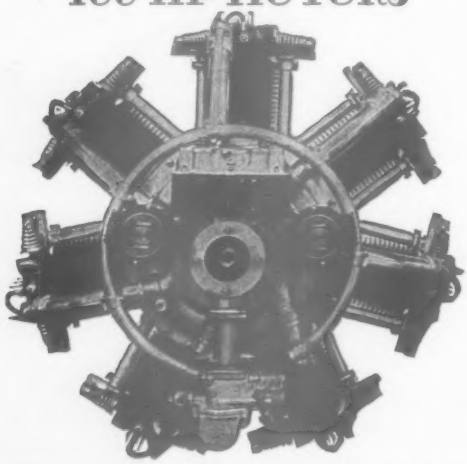

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STRONG—POWERFUL—an adventurer into the great air spaces. Everything you ask for in air travel—comfort—speed—safety—visibility—economy in original cost and performance.

This newcomer marks a step forward—a decided advance in airplane manufacture and construction. It is designed to do one thing—to carry your loads swiftly and safely at a minimum of cost. Inspired by the Vikings of old, it pushes forward to new conquests, greater achievements through the air. See the Viking at the All American Aircraft Show in Detroit, or if it is impossible for you to attend, send for our catalog and booklet, "Pay Load Profits."

SPECIFICATIONS

Span	36 ft.
Chord	6 ft. 6 in.
Wing Area	234 sq. ft.
Height	8 ft.
Length	26 ft. 1 in.
Wheel Tread	7 ft.

DATA

Weight empty	1100 lbs.
Useful load	1000 lbs.
Total weight loaded	2100 lbs.
Fuel capacity	50 gal.
Accommodations	3 passengers and pilot

PERFORMANCE

High speed	105 M. P. H.
Cruising speed	95 M. P. H.
Stalling speed	37 M. P. H.
Gas consumption 10 gal. per hr. full throttle	
Oil consumption	1½ qts. per hr.
Wing loading per sq. ft.	9 lbs.
Power loading, 120 Anzani, 17.5 lbs. per H. P.	

VIKING AIRCRAFT COMPANY
745 South Clark Street, Chicago

VIKING